S. HRG. 98-978

AIRBORNE LEAD REDUCTION ACT OF 1984

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

ON

S. 2609

A BILL TO AMEND THE CLEAN AIR ACT WITH REGARD TO MOBILE SOURCE EMISSION CONTROL

JUNE 22, 1984

Printed for the use of the Committee on Environment and Public Works

U.S. GOVERNMENT PRINTING OFFICE

37-670 O WASHINGTON : 1984

S32435

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ROBERT T. STAFFORD, Vermont, *Chairman*

HOWARD H. BAKER, JR., Tennessee
JOHN H. CHAFEE, Rhode Island
ALAN K. SIMPSON, Wyoming
JAMES ABDNOR, South Dakota
STEVE SYMMS, Idaho
PETE V. DOMENICI, New Mexico
DAVE DURENBERGER, Minnesota
GORDON J. HUMPHREY, New Hampshire
DANIEL J. EVANS, Washington

JENNINGS RANDOLPH, West Virginia
LLOYD BENTSEN, Texas
QUENTIN N. BURDICK, North Dakota
GARY HART, Colorado
DANIEL PATRICK MOYNIHAN, New York
GEORGE J. MITCHELL, Maine
MAX BAUCUS, Montana
FRANK R. LAUTENBERG, New Jersey

BAILEY GUARD, *Staff Director*
JOHN W. YAGO, JR., *Minority Staff Director*

CONTENTS

Page

OPENING STATEMENTS

Durenberger, Hon. Dave, U.S. Senator from the State of Minnesota 2
Evans, Hon. Daniel J., U.S. Senator from the State of Washington 6
Stafford, Hon. Robert T., U.S. Senator from the State of Vermont 1

WITNESSES

Bayh, Hon. Birch, attorney-at-law, and former U.S. Senator 59
Written statement 161
Blanchard, Lawrence E., Jr., vice chairman, Ethyl Corp. 49
Written statement 141
Bowditch, Fred, vice president, technical affairs division, Motor Vehicle Manufacturers Association 51
Cannon, Joseph A., Assistant Administrator, Air and Radiation, Environmental Protection Agency 6
Cole, Dr. Jerome F., president, International Lead Zinc Research Organization, Inc., accompanied by Dr. Robert Bornschein, associate professor, University of Cincinnati 28
Written statement 103
Goldstein, Dr. Bernard D., Assistant Administrator, Research and Development, Environmental Protection Agency, accompanied by Dr. Lester Grant, Director, EPA Environmental Criteria and Assessment Office 20
Written statement 73
Goldstein, Eric A., staff attorney, Natural Resources Defense Council, Inc. 46
Written statement 132
Houk, Dr. Vernon N., Director, Center for Environmental Health, Centers for Disease Control, Public Health Service, accompanied by Dr. James Pirkle 23
Written statement 87
Lincoln, Richard H., member, board of directors, National Marine Manufacturers Association, and director of environmental affairs, Outboard Marine Corp. 52
Written statement 149
McCowan, Robert T., vice chairman, Ashland Oil Co. 68
Written statement 202
Mielke, Dr. Howard W., Department of Geography, MacAlester College, and member of the Lead Coalition of Minnesota 44
Written statement 111
Needleman, Dr. Herbert L., director, Behavioral Sciences Division, Children's Hospital of Pittsburgh 25
Written statement 95
Redemer, Michael, Environmental Engineer Beacon Oil Co. 66
Written statement 196
Van Arsdall, R. Thomas, vice president, agricultural inputs and services, National Council of Farmer Cooperatives 63
Written statement 180
Zanotti, Martin P., executive vice president and chief operating officer, Saber Energy, Inc. 65
Written statement 189

ADDITIONAL MATERIAL

Financier magazine, article from 14

Page
Franklin, Benjamin, letter dated July 31, 1786 on the subject of lead poisoning 4
S. 2609 218
Statements supplied for the record:
Atlantic-Richfield Co. 207
Exxon Co. 210
Renewable Fuels Association 211
Union Oil Company of California 216

AIRBORNE LEAD REDUCTION ACT OF 1984

FRIDAY, JUNE 22, 1984

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 9:43 a.m., in room SD-406, Dirksen Senate Office Building, Hon. Robert T. Stafford (chairman of the committee) presiding.

Present: Senators Stafford, Durenberger, Evans, and Symms.

OPENING STATEMENT OF HON. ROBERT T. STAFFORD, U.S. SENATOR FROM THE STATE OF VERMONT

Senator STAFFORD. The committee will please come to order.

When the committee reported the Clean Air Act Amendments of 1984 last March, it deferred action on specific proposals to reduce or ban the use of lead in gasoline. The deferral was to allow the committee an opportunity to review the latest information on the issue as well as the authority and intent of EPA to issue more stringent regulations.

There is certainly no question about the terrible adverse effects lead can have on human beings. We know that children are especially at risk. High doses of lead are known to cause severe brain damage, and attention is now shifting to the possible disorders that may result from smaller doses.

The possible effects include mental retardation, learning disorders, and behavioral problems. There appears to be widespread agreement that lead should be eliminated from gasoline. The only remaining questions are: how fast we should move to achieve that result and what, if any, legislation is needed.

EPA has undertaken extensive reviews of issues related to airborne lead. In late March it published a study entitled "Costs and Benefits of Reducing Lead in Gasoline." The agency is also in the process of gathering information for use in determining whether to revise the ambient standards for lead.

Witnesses for EPA, together with others, will testify this morning on the health effects of lead on human beings, the relationship between levels of lead in gasoline and blood lead levels, and the problems that may arise from an early ban on lead in gasoline.

We will also explore whether there is a need for legislation to ensure that any necessary changes will be made.

Senator Durenberger has introduced legislation calling for a ban on lead in gasoline after January 1, 1988, and has taken a leading role in bringing this issue before the committee.

I would therefore like to ask Senator Durenberger to make any remarks he cares to at this time before we bring up our first witnesses.

Senator Durenberger.

OPENING STATEMENT OF HON. DAVE DURENBERGER, U.S. SENATOR FROM THE STATE OF MINNESOTA

Senator DURENBERGER. Mr. Chairman, I want to thank you for scheduling this hearing. As you have indicated, when the committee considered the Clean Air Act Amendments of 1984, I offered an amendment to ban the sale of leaded gasoline and subsequently introduced legislation to accomplish the same end.

Although the committee at that time was not prepared to report a ban, I am counting on this hearing to build some momentum that will ban lead at the earliest possible date.

Lead, as you have indicated, poisons kids—your kids and mine. So it comes as a surprise to find out that the principal source of lead in our environment is the family car. Automobiles are, in effect, high-speed aerosol cans of lead poisoning that clog up our city streets in large numbers twice a day. And the ironic thing is that automobiles don't need leaded gasoline. We won't be dumping our cars on a junk heap when we ban lead.

Although we have done a little to get the lead out, we have been doing too little for 10 years now; 45 percent of the gasoline sold in the United States today contains large amounts of lead. And it's out there because people want big engines that don't knock. It's out there because Detroit won't improve engine performance as European auto manufacturers already have done.

It's out there because alternative octane enhancers, which cost fractions of a cent more per gallon than lead, are priced at the pump 22 cents higher. It's out there because millions of Americans misfuel to save a few pennies on a gallon of gasoline. And it's out there because some refiners don't want to make an investment for public health until the marketplace for gasoline makes upgrading to unleaded an economic necessity.

We have known, Mr. Chairman, for hundreds of years that lead is toxic. Some historians attribute the fall of the Roman Empire to the lead content of wine and its use in unglazed pottery.

And there is a famous letter from Benjamin Franklin to his friend Benjamin Vaughan written in the year 1786 on the health effects of lead. Mr. Chairman, I would ask that the whole of Mr. Franklin's letter be printed in the hearing record after my comments this morning.

Senator STAFFORD. Without objection, it will be.

Senator DURENBERGER. But if I could, I would like to read one paragraph which describes what I believe to be the first legislation banning lead in this Nation.

Mr. Franklin said:

> The first thing I remember of this kind was the general discourse in Boston when I was a boy, of a complaint from North Carolina against New England rum, that it poisoned their people, giving them dry bellache, with loss of the use of their limbs. The distilleries being examined on occasion, it was found that several of them used leaden still-heads and worms, and the physicians were of the opinion that the mischief was occasioned by the use of lead. The Legislature of Massachusetts thereupon

passed an act prohibiting, under severe penalties, the use of such still-heads and worms thereafter.

Now, Mr. Chairman, 200 years later, we have startling new evidence which indicates that lead, even at low levels, is far more harmful to humans than previously thought. Those who run a special risk are young children and pregnant women. In children, high levels of lead affect the central nervous system, causing irreparable brain damage, mental retardation, coma, and death. At low levels, levels found in tens of thousands of today's kids, lead causes poor performance on intelligence tests, higher incidence of speech impairment, academic failure, and a larger number of psychiatric referrals.

Studies that will be brought to the attention of the committee this morning show that children suffer lower average IQ's of 1 to 3 points at blood lead levels that are all too common in this Nation today.

We will, of course, hear other evidence and arguments. We will hear that lead is being phased out gradually, that if we just sacrifice the health of a few more children, it will be gone with a minimum of regulatory cost. And the plight of millions of old, small, and specialty engines, from Buicks to Toros to chainsaws, will be put before the committee in the hope that our love for the engine will keep us from acting one more time.

Some say that the new tiger down at EPA will surely get the lead out of our tanks—and I hope he's there for as long as it takes us to ban lead. But I haven't seen the regulation. I know the hurdles it faces when it does come out, and I remember too well his predecessor.

I am convinced that we will ban lead by an act of this Congress. I am hopeful that members of the committee and its distinguished chairman will help me find the legislative vehicle this year.

I would be glad to set up a target earlier than 1988, and I am sure that we can meet the lubrication needs of the old, small, and specialty engines without using it in quantities and vehicles where it is unnecessary.

Let me close, Mr. Chairman, with one more quote from Benjamin Franklin's letter:

> This, my dear friend, is all I can at present recollect on the subject. You will see by it that the opinion of this mischievous effect from lead is at least above 60 years old; and you will observe with concern how long a useful truth may be known and exist before it is generally received and practiced on.

Mr. Chairman, it's my hope we can practice on the truth we learn today before this year is out.

[The Benjamin Franklin letter follows:]

THE FAMOUS FRANKLIN LETTER ON LEAD POISONING

"To Benjamin Vaughan

"Philadelphia July 31, 1786

"Dear Friend

"I recollect that, when I had the great Pleasure of seeing you at Southampton, now a 12 month since, we had some Conversation on the bad Effects of Lead taken inwardly; and that at your Request I promis'd to send you in writing a particular account of several Facts I there mentioned to you, of which you thought some good use might be made. I now sit down to fulfill that Promise.

"The First Thing I remember of this kind was a general Discourse in Boston, when I was a Boy, of a Complaint from North Carolina against New England Rum, that it poisn'd their People, giving them the Dry Bellyach, with loss of the Use of their Limbs. The Distilleries being examin'd on the occasion, it was found that several of them used Leaden Still-heads and Worms, and the Physicians were of Opinion, that the Mischief was occasioned by the Use of Lead. The Legislature of the Massachusetts there-upon pass'd an Act, prohibiting under severe Penalties the Use of such Still-heads and Worms thereafter. Inclos'd I send you a Copy of the Act. taken from my printed Law-Book.

"In 1724, being in London, I went to work in the Printing-House of Mr. Palmer, Bartholomew Close, as a Compositor. I there found a Practice, I had never seen before, of drying a Case of Types (which are wet in Distribution) by placing it sloping before the fire. I found this had the additional Advantage, when the Types were not only dry'd but heated, of being comfortable to the Hands working over them in cold weather. I therefore sometimes heated my case when the Types did not want drying. But an old Workman, observing it, advis'd me not to do so, telling me I might lose the use of my Hands by it, as two of our Companions had nearly done, one of whom that us'd to earn his Guinea a Week, could not then make more than ten shillings, and the other, who had the Dangles, but seven and sixpence. This, with a kind of obscure Pain, that I had sometimes felt, as it were in the Bones of my Hand when working over the Types made very hot, induced me to omit the Practice. But talking afterwards with Mr. James, a Letter-Founder in the same Close, and asking him if his People, who work'd over the little furnaces of melted Metal, were not subject to that Disorder, he made light of any danger from the Effluvia, but ascribed it to the Particles of the Metal swallow'd with their Food by slovenly Workmen, who went to their Meals after handling the Metal, without well washing their Fingers, so that some of the metal-line Particles were taken off by their Bread and eaten with it. This appeared to have some Reason in it. But the Pain I had experienc'd made me still afraid of those Effluvia.

"Being in Derbishire at some of the furnaces for smelting of Lead Ore, I was told, that the Smoke of the Furnaces was pernicious to the neighboring Grass and other Vegetables; but I do not recollect to have heard anything of the Effect of such Vegetables eaten by Animals. It may be well to make the Enquiry.

"In American I have often observ'd that on the Roofs of our shingled Houses, where Moss is apt to grow in northern Exposures, if there be anything on the Roof painted with white Lead, such as Balustors, or Frames of dormant Windows, etc., there is constantly a streak on the Shingles from such Paint down to the Eaves, on which no Moss will grow, but the wood remains, constantly clean and free from it. We seldom drink Rain Water that falls on our Houses; and if we did perhaps the small quantity of Lead descending from such Paint might, not be sufficient to produce any sensible ill Effects on our Bodies. But I have, been told of a case in Europe, I forgot the Place, where a whole Family was afflicted with what we call Dry Bellyach, or Colica Pictonum, by drinking Rain Water. It was at a Country-Seat, which being situated too high to have the Advantage of a Well, was supply'd with Water from a Tank, which received the Water from the leaded Roofs. This had been drunk several Years without Mischief; but some young Trees planted near the House growning up above the Roof, and shedding their Leaves upon it, it was suppos'd that an Acid in those Leaves had corroded the Lead they cover'd and furnished the Water of that with its baneful Particles and Qualities.

"When I was in Paris with Sir John Pringle in 1767, he visited La Charite, a Hospital particularly famous for the Cure of that Malady, and brought from thence a Pamphlet containing a List of the Names of Persons, specifying their Professions or Trades, who had been cured there. I had the curiosity to examine that List, and found that all the Patients were of Trades, that, some way or other, use or work in Lead, such as Plumbers, Glaziers, Painters, etc., excepting only two kinds, Stonecutters and Soldiers. These I could not reconcile to my Notion, that Lead was the cause of that Disorder. But on my mentioning this Difficulty to a Physician of that Hospital, he inform'd me that the Stonecutters are continually using melted Lead to fix the Ends of Iron Balustrades in Stones; and that the Soldiers had been employ'd by Painters, as Labourers, in Grinding of Colours.

"This, my dear Friend, is all I can at present recollect on the Subject. You will see by it, that the Opinion of this mischievous Effect from Lead is at least above Sixty Years old; and you will observe with Concern how long a useful Truth may be known and exist, before it is generally receiv'd and practis'd on.

"I am, ever, yours most affectionately,

"B. Franklin"

Senator STAFFORD. Thank you very much, Senator Durenberger.

I am glad to see that Senator Evans is with us. Do you have a statement this morning, Senator?

OPENING STATEMENT OF HON. DANIEL J. EVANS, U.S. SENATOR FROM THE STATE OF WASHINGTON

Senator EVANS. Mr. Chairman, I will wait for the testimony, but I will say in advance that I am going to be very interested and will engage in whatever questions are necessary to elicit information on the relationship between the medical problems we have observed with lead and automobile emissions. I will be interested in the testimony on the adverse consequences, if there are any, on automobile engines with the banning of lead. And I will be interested in the cost differential in refining as opposed to the cost differentials currently at the pump between leaded and unleaded gasoline.

I may have some other questions, too, but I will wait until we get to that testimony.

Senator STAFFORD. Thank you very much, Senator.

That brings us to our first witness, Mr. Joseph Cannon, Assistant Administrator for Air and Radiation, Environmental Protection Agency.

Mr. Cannon, we are glad you're here, and we look forward to your testimony. In your case, we will allow you the option of reading your statement or summarizing it, whichever you prefer.

STATEMENT OF JOSEPH A. CANNON, ASSISTANT ADMINISTRATOR, AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Mr. CANNON. Thank you, Mr. Chairman. I believe I will read the whole statement, since it's a fairly brief statement.

Senator STAFFORD. All right.

Mr. CANNON. I am pleased to be here before your committee today, and without being too presumptuous, I would like to compliment Senator Durenberger on a very literate and compelling opening statement. I appreciate the opportunity to testify today on S. 2609, a bill designed to remove lead from gasoline once and for all.

I would like first to recount EPA's past and current efforts to get lead out of gasoline. Then I will briefly comment on the legislation before you.

Since the early 1970's, Congress and EPA have recognized that exposure to lead constituted a major public health concern. In urban areas, leaded gasoline emissions contribute to the overwhelming majority of airborne lead. This lead is then inhaled or enters the dustfall and is ingested by children, resulting in adverse health effects ranging from learning disabilities to acute neurological and physiological disorders.

As a result, EPA instituted a program to phase down the allowable lead content in gasoline. I should note that our authority to control lead in gasoline derives from section 211(c) of the Clean Air Act, which allows EPA to regulate fuel or fuel additives based on endangerment of public health or impairment of emission controls.

Under another section of the act, section 109, EPA has also established a national ambient air quality standard for lead based on air quality criteria under section 108 of the Clean Air Act.

Because of the pervasive nature of lead from gasoline in urban areas, EPA first employed section 211 to address the lead-in-gasoline issue, only later using the ambient standard process, essentially as a means of addressing stationary sources of lead such as smelters.

The air quality criteria for a pollutant undergoes review every 5 years, and EPA is now revising the criteria document for lead, as Dr. Goldstein will mention later.

I only point out that that process is separate and distinct from our regulatory authority under section 211.

The lead phasedown program was to have culminated in 1982 with a 0.5 gram per gallon standard, averaged across all gasoline produced at a refinery. In other words, a refinery could produce half unleaded gasoline and half leaded gasoline at one gram per leaded gallon. The problem was that as refiners produced more unleaded gasoline, they could under this pool average concept add more lead to their leaded gas, so overall lead usage would not necessarily decrease.

Therefore, in 1982, EPA switched to a standard applicable to the lead content in leaded gasoline. That 1.1 gram per gallon standard was intended to result in a phased reduction of overall lead usage as leaded gasoline began to disappear from the marketplace.

This switch to a lead-in-leaded gasoline standards came at a time when the Public Health Service produced compelling evidence that as long suspected, a direct relationship existed between the amount of lead in gasoline and blood lead levels in children.

Unfortunately, insidious gasoline purchasing practices on the part of some consumers have thwarted our objective. We had envisioned that with our tougher lead-in-leaded gasoline standard, leaded gasoline would quickly recede from the marketplace and virtually disappear by the 1990's. But the practice of misfueling, using leaded gasoline in vehicles designed for unleaded gasoline, is occurring at an alarming rate.

As I testified before this committee in February, misfueling is affecting about 13 percent of the auto fleet. This practice quickly destroys catalytic converters and increases auto emissions by as much as 800 percent. This leads to higher levels of ozone and carbon monoxide in the air. Excessive levels of ozone causes shortness of breath, reduced ability of the lungs to exchange air, and difficulty with breathing. Carbon monoxide reduces the supply of oxygen to organs and muscles of the body. And because of misfueling, sales of leaded gasoline and resultant lead emissions remain high. Leaded gasoline sales still account for 45 percent of all gasoline sales, despite the fact that virtually all vehicles since 1975 have required unleaded gasoline.

As a result, we went back and reviewed our lead phasedown program. We found that the health effects data still overwhelmingly support the long-established goal of removing lead from gasoline. Indeed, additional studies and more detailed analysis of the relationship between gasoline lead and blood lead suggested that an

even more rapid phaseout of lead could eliminate tens of thousands of cases of lead toxicity each year.

Moreover, EPA estimates the monetized benefits of taking lead out of gasoline outweigh the costs. In fact, looking at 1 year, 1988, the monetized benefits are estimated to surpass the costs by roughly $700 million. The benefits include reducing conventional pollutants by eliminating misfueling, reducing medical costs due to lead exposure, and reducing vehicle maintenance costs.

These figures do not include benefits from reducing blood lead levels already below the level accepted by the medical community as signifying the need for treatment, despite growing evidence of adverse effects associated with even lower blood lead levels in children.

We have found that eliminating lead would result in a reduction of 2.5 million tons of hydrocarbons, carbon monoxide, and nitrogen oxide emissions in 1988. We estimated the benefits of those reduced emissions three ways: Using the cost of alternative regulations that EPA is considering; using the cost of emission control equipment disabled by misfueling; and directly monetizing the health and welfare benefits. These three methods actually resulted in similar estimates, with the average around $400 million.

To estimate the benefits associated with the health effects of reduced lead exposure, we assigned values for reductions in the number of children above 30 micrograms per deciliter. Two health-related effects were studied: Medical treatment costs and compensatory education. These represented benefits of $236 million, again even without considering the value of adverse effects in adults and infants under 6 months.

For vehicle maintenance benefits, we considered the potential savings from reduced exhaust system corrosion, from fewer spark plug changes, and from fewer required oil changes. Not counted were the possible fuel economy benefits. Maintenance savings in 1988 were estimated to be over $750 million. In all, we estimated 1988 benefits totalling over $1.3 billion.

We are currently in the process of developing a proposed rule to expedite the removal of lead from gasoline. And I expect that within the next few weeks we will be prepared to issue that proposal for public comment.

One issue we will raise in the rulemaking is what to do about trucks and older cars that don't require unleaded gasoline. There is some evidence that pre-1971 cars and some heavy-duty trucks need some lead in gasoline to prevent damage to the valves. Existing studies suggest that as little as .07 to .10 grams per gallon is sufficient for valve lubrication in these vehicles.

At this point, it appears that a short-term solution will be to allow the sale of low-lead gasoline for vehicles requiring lead. We have looked at whether alternative additives are available, but current data on alternative additives are too limited to propose their use for the short term.

I have just a few brief comments on the legislation before you. Before that, however, I would like to applaud Senator Durenberger's and this committee's leadership on the misfueling issue. The amendments which you passed as part of the Clean Air Act reauthorization bill making individuals liable for misfueling and

tampering, expressly prohibiting the sale of tampering devices, and providing for administrative penalties will, if ultimately passed into law, help us in our battle against misfueling and tampering.

On the bill before you I note that not only does EPA have under section 211(c) of the Clean Air Act adequate authority to deal with the lead in gasoline issue, but as I have just outlined, we are in the midst of that process. I therefore think that legislative action at this time is unnecessary.

Of course, we and the sponsors of the bill share the goal of getting lead out of gasoline. However, there are some subsidiary issues best addressed in an open and orderly regulatory process where all parties have had an opportunity to present their views and a careful analysis performed.

For example, the bill has an effective date of January 1, 1988. It may well be that an earlier date is feasible or that a later date is more appropriate. It is also possible that a control strategy short of an immediate total ban on leaded gasoline may be warranted.

In short, then, I certainly agree with the sentiment of the bill, but believe that EPA is well equipped—not only well equipped but has the intention and the will—at this stage to deal with this issue in an expeditious and orderly fashion.

Thank you for this opportunity to testify. I will be happy to answer any questions that you may have.

Senator STAFFORD. Thank you very much, Mr. Cannon.

I note that several times there is comment on lead in children as a result of using leaded gasoline. What about adults?

Mr. CANNON. Probably there are more witnesses later who can answer that question better than I. The fact is that adults—I am so reluctant, knowing that there are so many experts behind me on this—that adults don't ingest lead, plainly as much lead, as children. I know my kids would never believe this would happen, but kids turn out to eat dirt and all kinds of other things, and that they just get more lead in their systems, plus they are just more susceptible than adults.

Someone else might have a specific answer on the lead effects in adults.

Senator STAFFORD. I would assume if it has an adverse effect on children, that there must be some adverse effect on adults as well.

Do you believe that EPA's existing authority under section 211 of the Clean Air Act to ban or further restrict the sale of leaded gasoline is clear enough to withstand the inevitable legal challenges to such an action?

Mr. CANNON. Yes; we have already withstood two, at least two, court challenges on this. And we believe not only the statutory authority, but our authority as interpreted by the courts, gives us ample authority to ban lead if necessary.

Senator STAFFORD. I think you have touched on this question, but let me ask you this, first telling you that we are getting letters asserting that antique cars and other old vehicles which are still in use will not operate on unleaded gas. Is there any truth to these assertions?

Mr. CANNON. We have done at least one study that shows that there is some need for a very small amount, less than a tenth of

the amount of lead in gasoline now, which has already been reduced over the years, to avoid certain engine problems.

In the proposal I have described to you or told you we are about to come out with, we discuss this issue, and we ask for further comment on it.

We, too, of course, are getting a lot of letters from antique car owners, and we are going to ask for comment on how the agency might best address this issue.

But it does appear that a certain amount of lead, as I say, a very, very small amount may be needed in some of these vehicles.

Senator STAFFORD. There are lots of motorcycles and motors in marine use; are they able to run on unleaded gas today?

Mr. CANNON. I don't know the answer for each class of vehicles, but that again is an issue that we're going to seek comment on to find out what the need is, the extent of the need, and how the agency might respond to that.

Senator STAFFORD. All right.

Is it accurate to say that the agency's cost-benefit analysis shows that the maintenance and misfueling benefits of eliminating lead alone, putting aside health benefits, outweigh the cost of the lead ban? I think you may have touched on that in your statement.

Mr. CANNON. I think the maintenance costs alone will outweigh the—or maintenance benefits alone will outweigh the costs.

Senator STAFFORD. Gasoline which contains lead also contains lead scavengers, such as ethylene dibromide, or EDB, to prevent engine fouling. EDB is known to be a potent carcinogen. Why doesn't the agency's cost-benefit analysis assign any value to the elimination of EDB from gasoline?

Mr. CANNON. Well, about 50 million pounds of EDB are used in gasoline at present. Only about 300,000 pounds of that survives the combustion process. You're talking about nearly an infinitesimal amount of EDB that actually survives the combustion process. And we just weren't able to assign a benefit to that. It's a very, very small amount, although it turns out that the use of EDB in gasoline I think is the largest, overwhelmingly the largest, use of EDB.

Senator STAFFORD. Thank you. I will just comment, in closing my questions, that recently we have acquired in our family two very small gasoline-powered units. One is a small electrical generator. And I note that each one specifies unleaded gas, which indicates to me that even very small gasoline motors now are designed to use unleaded rather than leaded gasoline.

I will comment further that I bought it because it had a Good American seal on it, though when I looked on the bottom, I noted it said, "Made in Japan."

Senator Durenberger.

Senator DURENBERGER. Thank you, Mr. Chairman.

Joe, let me start with one little quote out of your opening comment. Let me first restate my compliments to you and to the Administrator for your commitments to this problem.

So let me just ask you, you point out—and I won't argue the point of section 211 or the authority that EPA has to ban lead, and you indicated you're moving to do that. But it also seems that that means that your successor would also have the authority to allow leaded gasoline. Is that not true?

Mr. CANNON. Well, technically, that's true. I—the body of evidence is so overwhelming that I just can't imagine any successor allowing it. But it is under the act that the agency would have to make findings contrary to the findings which we have already made. And I just—I don't know how that could happen. You would have to produce scientific studies that are contrary to the overwhelming and near universal findings that the agency over the past 3 years has made on this subject.

Senator DURENBERGER. But the reality is that there is nothing that requires a ban. The authority is there to ban it or approve it.

Mr. CANNON. That's true. That's correct.

Senator DURENBERGER. Is it your understanding of the bill that I have introduced with a number of cosponsors in this committee, that if we pass this bill, we could guarantee that the sentiments of any future chief of EPA would, in effect, correspond to all of that evidence that you talk about and that we would ban lead? Is that not correct?

Mr. CANNON. That's true.

Senator DURENBERGER. Now, as to the bill itself, my reading of the bill says that you have to do it by January 1, 1988. So it gives you room to do it sooner than that. Is that not correct?

Mr. CANNON. Yes.

Senator DURENBERGER. And as a matter of interest, would you have any comment on the earliest date that a ban might be effected?

Mr. CANNON. Sure. We are going to ask—I don't want to get too much into the details of the proposals, since it's some weeks off—but we are probably going to talk about dates ranging from some phasedown beginning in 1985 to 1988 and then different options for phasing down thereafter. So it would be over that period of time.

Senator DURENBERGER. You also mention that the decision should be developed in a regulatory framework, and I can understand that. I don't believe that the bill precludes regulation; in fact, it mandates that the Administrator issue regulations. Isn't that also correct?

Mr. CANNON. That's right.

Senator DURENBERGER. And the bill would allow you to authorize the sale of gasoline with low amounts of lead. Is that not correct?

Mr. CANNON. Yes.

Senator DURENBERGER. So in fact, the only way in which it might interfere with your rulemaking is if you decided to allow the sale of leaded gasoline—that is, gasoline with large amounts of lead—after 1988. Is that not correct?

Mr. CANNON. Yes; although I wanted to say one thing. I don't think I said it would interfere with our process; I just said that we think, because of the actions we're taking at the agency, that it's not necessary.

Senator DURENBERGER. At this stage.

Mr. CANNON. I said we have the will at this stage; that is, the intention.

Senator DURENBERGER. I heard you say that.

Then can you guarantee this committee that under your current authority and regardless of who is President of the United States or who heads up the OMB regulatory committee, or who the Ad-

ministrator of EPA is, that leaded gasoline will be out of the marketplace by 1988 except for limited lubricant use?

Mr. CANNON. From my own perspective and from my own honest understanding and knowledge of it, I believe I could guarantee that. I can't become the guarantor, though, for things that are completely outside my control.

But I can say this. This administration, even in 1982, amid other controversial activities of the agency, did move to dramatically—against very determined and entrenched opposition—to take a very dramatic step which we thought, and the community in general who follows these things thought, would solve the problem. We took that step. I am personally familiar with all the activities related to that and have complete confidence that we not only are going to propose this, in fact we are not running into stiff opposition from most parties. This is something there is a widespread concurrence in.

I not only expect we can propose, but I expect that we would finalize, promulgate a rule, by the end of this year. And I am just as confident of that, and I would be willing to commit to that in any way you would like me to commit to it.

Senator DURENBERGER. Could you describe for us your general regulation of lead under section 109 of the Clean Air Act, what your experience has been, what the problems are, and what does the near future, considering that you are drafting a new criteria document, hold for us?

Mr. CANNON. Dr. Goldstein is going to speak more fully to that.

But we have a number of ambient air quality standards, of which one is lead. And we have set that standard based on a thorough scientific analysis of the different studies to find out what level of lead we could permit that would be protective of health. And that covers the entire country.

The agency has had historically a little difficulty in implementing this. But presently, pursuant to a court order, I am sorry to say, the agency is requiring and obtaining in an orderly manner State implementation plans from the various States where lead smelters, primary and secondary lead smelters, are.

There turn out to be a fairly small number of stationary sources that contribute to the lead problem, as I mentioned earlier, and that you note, is dominated by automobile emissions. But that's about the stage we are within the agency with respect to the lead ambient air quality standard.

Senator DURENBERGER. Then finally, for those people who are interested in following bureaucratic ways and for those who are interested in continuing to sue you, if you were to publish a proposed rule on lead as a gasoline additive, let's say, in July of this year, what would the likely regulatory schedule be until it is effectively banned? Just run us through that process in a time frame.

Mr. CANNON. Well, the time for a lawsuit, just for the sake of the lawyers in the room, would be probably around the end of this year. That would be the time we would have a final agency, a final reviewable action by the agency, where we expect that we would promulgate a rule by the end of the year. Then, of course, people would be free to go to the court of appeals, as they have in the past on this and most of our other regulations. But by the end of this

year would be the time that we expect to have promulgated the rule.

But to answer the question as to when lead would be out, that would depend upon the comments we get. As I say, we're thinking of a range that would begin some quick phaseout in the middle of 1985 all the way to—I am not sure what the ending dates would be—but to taking it down pretty dramatically at the beginning of 1986 or some phaseout up to 1988. Those would be the ranges of dates we are considering.

Senator DURENBERGER. Well, is all the comment period in 1984, in effect?

Mr. CANNON. Oh, yes. We would issue the proposal in mid-July or so. We would have a public comment period. We will have a public hearing, which people are free to come in. And then we assimilate all those comments. When we did this in 1982, it was the, I believe, largest public hearing the agency had. We had many witnesses over a 2-day period and dozens, if not hundreds, of comments.

We assimilate all those comments, and then we promulgate the regulation.

Senator DURENBERGER. Mr. Chairman, I thank you. I wonder if I might ask permission to put in the record at this point as corroboration of Mr. Cannon's testimony an interesting analysis John Berry wrote in the Financier on the subject of OMB's review of a cost-benefit study on lead. I think it was—I am sure it was—the first and only time that Chris Demuth ever liked anything you were doing in the regulatory area. And I think it ought, for historical purposes if nothing else, to be in the record.

Senator STAFFORD. Without objection, we will put it in the record.

[The article referred to follows:]

The Ethyl Case: Pros and Cons of Cost/Benefit in Regulation

by John M. Berry

Weighing the costs and benefits of proposed Government regulations has always generated an enormous amount of controversy, given the apparent reasonableness of the idea.

In some cases, critics objected because they were certain that some new regulation was needed and they were not happy with some opponent flashing a fancy set of numbers purporting to show that the costs would be greater than the benefits.

In others, there were complaints that hard-hearted analysts were putting a price on something priceless — human life or suffering.

And in still others, backers of a proposed regulation were simply convinced that the other side would cook the books to try to prove a point.

Indeed, the opposition to cost-benefit analysis has usually come from groups favoring more Government regulation of working conditions — the environment, automobile safety and the like. Environmental activists routinely have denounced cost-benefit studies as just another device used by business and conservative politicians to block urgently needed actions to protect society.

Occasionally, however, the shoe has pinched other feet, as Ethyl Corp. learned recently.

Ethyl last year earned $106 million on sales of more than $1.7 billion, with more than one-quarter of its profits coming from the product for which the company is best known, the tetraethyl-lead additive used to raise the power content or octane rating of gasoline.

Those profits have fallen in recent years as the use of the lead additive has declined. The catalytic converters introduced on automobiles nearly a decade ago to control a variety of auto emissions are quickly clogged and rendered useless if leaded gasoline is used. As the country's fleet of cars slowly turns over, sales of leaded gasoline, and tetraethyl lead, have gone down.

Recently the Office of Policy Analysis at EPA released a draft study of the costs and benefits of reducing lead in gasoline that would put an even larger dent in Ethyl's bottom line.

The study's conclusion: The nation would benefit by more than three-quarters of a billion dollars a year if oil refiners were required to remove all or almost all of the lead from gasoline.

Administration officials who have been distinctly skeptical about the need for new or tightened regulations of all types said the study's results provide a firm basis for reducing the lead in gasoline.

'The Finest Ever'

One Government economist termed it simply "the finest cost-benefit analysis I have ever seen."

Christopher DeMuth, Administrator for Regulatory Affairs at OMB and a frequent target of environmentalists and others for helping block regulatory

John M. Berry reports on economics for The Washington Post.

changes, called the new study "a very fine example of an economic analysis of a regulatory issue. It is a model of how regulatory issues in the health area ought to be approached."

The reaction to the study by Ethyl Corp., however, was harsh and bitter.

Vice Chairman Lawrence E. Blanchard Jr., who has been fending off attacks on the use of lead for years, declared: "If any responsible person would take the time to read this latest internal report by some staffers at the EPA, they would be simply shocked to see what a juvenile and simplistic approach is now being taken by EPA to justify their efforts to further reduce lead in gasoline.

'Absurd Hypothetical Examples'

"They claim they don't know how to quantify the benefits of lead in gasoline but use absurd hypothetical examples to attempt to quantify the benefits of lead-free gasoline. The health parts of the statement are contrary to the latest studies they have commissioned."

EPA is expected to propose a lead-reduction regulation that would require refiners to use no more than 0.1 gram of lead per gallon, probably by 1988, compared with the 1.1 grams allowed now.

Alternatively, lead could be banned altogether. EPA Administrator William Ruckelshaus has said that the agency was considering a ban.

However, other EPA officials had indicated that the 0.1-gram approach "is the approach the agency is working on."

Either way, Ethyl Corp. would be unhappy, just as it is unhappy with the cost-benefit study. "Some economists wrote most of this report, using fancy terms," said C.A. Hall, assistant director of air conservation for the company. "They calculated to the penny any costs of leaded fuel, but when it comes to the benefits, they don't have any numbers."

A lack of numbers is often a problem in careful cost-benefit studies involving complex issues. The impact of a new regulation sometimes cannot be determined with any precision, and even if that can be done, it may not be possible to estimate reliably what the monetary effects will be.

Tetraethyl lead has been added to gasoline for about 60 years as a relatively inexpensive way to raise the octane rating — the useful energy content — of gasoline. With it, gasoline of a desired power can be produced using less crude oil, and at a lower cost of refining.

Concern About Health

The basic push to remove all or most lead from gasoline originated with concerns about the health effects of lead on human beings, particularly children who are more sensitive to it than adults.

Undisputed health studies have shown that lead taken into the body can build up to high levels and produce a wide variety of problems, including lowered mental capacity, anemia, kidney damage and high blood pressure.

The EPA has the authority under the Clean Air Act to determine what level of lead is allowable in gasoline.

"Our regulations ought to be aimed at providing the largest social benefit," said Mr. DeMuth of OMB. "In our view, the cost-benefit analysis should be the basis of the regulations.

"We have gone over [the lead cost-benefit study] in great detail," he continued. "There are some issues unresolved and it has been released for public comment...What Ethyl ought to do is go beyond denunciations and tell us where the study is wrong.

"Some issues are easier to analyze than others. This one is particularly complex," Mr. DeMuth acknowledged. "It analyzes subtle issues in a very thorough manner,"

and where there is not sufficient information to do so, it does not attach numbers to either costs or benefits.

While the emphasis on reducing lead in gasoline has been related primarily to health concerns, the new study finds that more of the monetary benefits from reducing it would come from savings associated either with maintenance of cars and light-duty trucks or from reducing air pollutants other than lead.

The study said that reducing lead to 0.1 gram per gallon would have a value of $660 million annually as a result of less frequent replacement of mufflers, tailpipes and spark plugs; less frequent oil changes, or less engine wear if oil was already not being changed as often as it should be, and marginally better gas mileage due to a combination of factors.

Offsetting Cost of Wear

Banning lead entirely would raise that benefit to $755 million a year, but also would impose an offsetting cost in greater wear on auto and truck engine-valves that lead helps prevent in older vehicles. Heavy-duty trucks being made today still need lead to reduce valve wear.

It is this offsetting cost of valve wear, and the omission of any monetary estimate of it, that Messrs. Blanchard and Hall of Ethyl stressed. Replacing a cylinder head after excessive valve-seat wear could cost between $500 and $1500, Mr. Hall estimated.

He agreed that use of leaded gasoline shortens the life of mufflers, tailpipes and spark plugs, but he put that added maintenance cost at the equivalent of about 2 cents a gallon of gasoline used. "My gosh, the makes up for any savings." he observed.

But, as Mr. DeMuth noted, the EPA study is concerned about total costs and benefits to society, not just to one group.

The study makes no attempt to predict what would happen to prices at the pump. It points out instead that the cost of manufacturing 87-octane unleaded gasoline, according to market prices, is consistently less than 2 cents a gallon more than for making 89-octane leaded gasoline. Average pump prices are about 7 cents more, however.

EPA assumes that gasoline stations' profit margins won't rise just because of a change in lead content, so that, while users of the 0.1-gram leaded gasoline probably would end up paying more per gallon, the price of unleaded gasoline would come down at the same time.

Additional Refining Steps

If lead is not used, to produce a comparably powerful gasoline would require additional steps at the refinery such as adding volatile "aromatics" to the product. All that costs money since more crude oil, more refinery machinery and more energy is needed.

The EPA study puts that added manufacturing cost at $503 million a year for the low-lead option or $691 million for a total ban.

The reason the EPA analysts put no price tag on the valve-wear question, they said, is that it is impossible to estimate accurately.

It may not be a problem at all: "Several studies using fleets of drivers under more typical conditions found little or no incidence of valve problems with unleaded gasoline," the new analysis said.

Thus, putting a price tag on this cost would involve, among other things, trying to figure out to what extent vulnerable older cars would be driven at high speeds and for how long — an impossible task, in the opinion of the study's authors.

But they acknowledge the risk, particularly to heavy-duty trucks — even new ones — and older cars. That is the major

reason for the 0.1-gram alternative, EPA officials said.

Ethyl's Mr. Hall agrees that the valve-wear problem could be handled with much lower use of lead than now, but he said it would still require at least 0.2 grams per gallon.

The Ethyl officials also point out the distributional consequences of lowering lead and raising the cost of leaded gasoline: "It would happen to people least able to pay" — the owners of older cars — Mr. Hall warned.

Damage from Misfueling

In addition to the $600 or $770 million in maintenance benefits, the study calculates a saving of $404 million annually from reduced damage from other pollutants that now occurs because of widespread misfueling. Other studies have shown that a growing percentage of drivers of cars designed to use just unleaded now buy leaded gasoline either because it is cheaper or because the higher octane stops engine knocking.

The misfueling renders useless the vehicles' catalytic converters, thus increasing emissions of hydrocarbons, nitric oxide and carbon monoxide. Eliminating these emissions would reduce the health-care costs of individuals with acute problems such as asthma by about $146 million a year. Similarly it could cut damage to agriculture, primarily from more ozone, by $160 million a year.

The reduction in lead emissions would lower health-care costs and costs associated with reduced cognitive abilities among children with high lead levels by between $225 million and $236 million a year, depending on whether lead were banned or reduced to the 0.1-gram standard, the study said.

For children with lower but potentially damaging lead levels, the study places no monetary value on lowering lead content. The authors believe there would be a benefit, but as with the cost of potentially greater engine-valve damage, they said the data were too uncertain to support a monetary estimate.

Ethyl officials deny that there is any evidence that those lower levels of lead have any adverse affects on children.

EPA officials believe, though, that, perhaps for the first time, there is such evidence.

But they argue that since they place no monetary value on reducing lead in such children, and the study still shows a substantial positive cost-benefit balance, that it should make no difference in the regulatory outcome even if Ethyl were right.

At OMB, Mr. DeMuth noted that some other recent cost-benefit studies by EPA and other agencies have indicated that more regulation could add to the nation's welfare, and that, in others, regulations were not worth the cost. Whichever way the economic analysis pointed, however, the groups and companies with a large stake in the outcome are always vocal.

'Away from Rhetorical Exercises'

"These regulatory proceedings are always contentious and the rhetoric does tend to get very hot," he said. "The empirical analysis does help. We have moved away from rhetorical exercises."

No cost-benefit study is ever going to convince opponents in all regulatory battles that there is a single correct answer to whatever problem is on the table. Certainly the officials at Ethyl dismiss the findings of this one out of hand, with lots of rhetoric attached.

But as one economist whose work was one of many cited in the EPA study put it: "This ought to show people that economics is not necessarily inimical to the environment. That's the great hook to this." □ □ □

Senator STAFFORD. The Chair will note that when Senator Durenberger asked you to guarantee something in 1988, that probably the only thing we can guarantee we will have at that time will be death and taxes.

Senator Evans.

Senator EVANS. Well, I might add to that that my term doesn't run out till 1988.

Do you have any information on the percentage of automobiles now on the road that use unleaded versus leaded gasoline?

Mr. CANNON. By all of our estimates—I don't know the percentage of cars, but of the total amount of leaded gasoline, probably only about 35 percent of the gasoline pool should go for cars that use leaded gasoline, whereas in fact leaded gasoline makes up about 45 percent of the marketplace.

Senator EVANS. Well, that's what I was trying to get at is the differential between what ought to be and what is. So there is apparently a pervasive and, as I understand it, growing abuse of leaded gasoline being put into automobiles that take unleaded?

Mr. CANNON. That's right. How pervasive it is, we don't know. It varies regionally, but our estimates show that at least 13 percent of the fleet is misfueling some significant percentage of the time.

We have recent studies that are showing that it may be even greater than that.

Senator EVANS. Perhaps you're not the right one to ask, and at some point later in the testimony I hope to find somebody who can tell me accurately, but do you know what the price differential is in refining of unleaded versus leaded gasoline?

Mr. CANNON. Well, it may be better to talk in terms of cost at the refinery and price at the pump. Cost at the refinery level, we figure, is somewhere around 2 to 3 cents per gallon difference in unleaded versus leaded. That changes, however, because of marketing practices at the pump—it varies, you know, but the average would be between 8 and 11 cents difference. Some places it's more and some places it's less.

Senator EVANS. Well, that's what I intend to pursue.

Mr. CANNON. Yes.

Senator EVANS. The differential in actual cost and the differential at the pump. We may well get into some marketing questions here a little later on this morning.

Mr. CANNON. Well, marketing is one of the significant issues. One of the reasons for driving down the amount of lead in gasoline is the hope on our part to flip that price-at-the-pump effect, so that leaded gasoline does not appear to be lower in price at the pump. So that's an important issue for us.

Senator EVANS. I would be curious to find out why the major differential between leaded and unleaded gasoline at the pump.

Mr. CANNON. There's no question—I have talked to a number of gasoline marketers, and others I am sure would be able to testify to this, that essentially it's used— leaded gasoline is used—as a loss leader. That's to say, you can put up a lower price, attract people in. In large part, it's a marketing practice.

Senator EVANS. It's a fine marketing practice to use a killer as a loss leader.

Mr. CANNON. Well, obviously we don't endorse this. That's one reason we're trying to figure out how to do something about it.

Senator EVANS. Maybe instead of banning lead, we should just mandate that the price of leaded gasoline is 10 cents higher per gallon than unleaded, or 20 or 30.

Is there any question in your mind at all as to the relationship between leaded gasoline and health effects?

Mr. CANNON. In my own mind, there is absolutely no question. I have looked at this, as I said, for going on 3 years of my experience at the Environmental Protection Agency, and I have never seen as clearly documented a relationship between an environmental pollutant and a health effect caused by that pollutant.

Now, I am sure that you can do some statistical analysis which might weaken that relationship, but we have done as much statistical analysis as could be done at the agency to examine this relationship between—at least between lead in gasoline and blood lead levels in children, and find—and Dr. Houk is going to testify more fully on that—find a near 1-to-1 relationship. As the lead in gasoline, which it has come down dramatically since the 1970's, as that lead comes down, the amount of blood lead in children comes down. It's just as clear as anything can be.

Senator EVANS. Even though we've made some progress, apparently the major public health concern has been known since the early 1970's, according to your testimony. Your testimony also shows that the health problems are clearly identified and the cost benefits, something close to a quarter of a billion dollars a year, are well stated, that we have large and growing misfueling of automobiles. But it's not the early 1970's. It's 1984. And we are still debating the question of whether to eliminate lead from gasoline. It seems to me that's an excessively long time. And I know much of that precedes your leadership in the EPA.

But while you say a law may not be necessary, if a law were passed, would you appreciate having it on the book?

Mr. CANNON. I can't disagree with a statute. We are going to do what the law will require, possibly before it can even be enacted.

Since 1971, just to put it in perspective, in 1971 there were about 200 billion grams of lead in leaded—in gasoline—and this year it's 40 billion grams. So there has been a very dramatic reduction. In 1982 we thought we had solved the problem and that, in the same timeframe that we're talking about in this regulation and in Senator Durenberger's bill, would have had lead eliminated. Unfortunately, as I mentioned, because of the fuel switching, we are now having to relook at it.

In other words, we have known for some time, and we thought we had been taking action. Unfortunately, in Washington you can't always design the regulation which is going to do ultimately what you think it will do. And this is why we're refining it now.

Senator EVANS. Well, it seems to me that we can work in parallel. If the law gets there before the regulation, so much the better.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you very much, Senator Evans.

And thank you very much, Mr. Cannon. We have appreciated your appearing with us this morning.

We are now going to go to the first panel. We have with us this morning Bernard D. Goldstein, Assistant Administrator for Research and Development, EPA; Dr. Vernon Houk, who is Director, Center for Environmental Health, Centers for Disease Control, Atlanta; Dr. Herbert L. Needleman, director of Behavioral Sciences Division, Children's Hospital of Pittsburgh; and Dr. Jerome F. Cole, president, International Lead Zinc Research Organization, New York.

Gentlemen, it would be my intent to call on you in the order in which we have announced your names. In view of the usual time constraints, which never does justice to the work which you do preparing to come here and the trouble you have gone to to come here, we would ask you to confine your statements to 10-minute summaries, and your statements will be placed in the record in full. We will be watching the clock.

So, Mr. Goldstein, you're up.

STATEMENT OF DR. BERNARD D. GOLDSTEIN, ASSISTANT ADMINISTRATOR, RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY DR. LESTER GRANT, DIRECTOR, EPA ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE

Dr. GOLDSTEIN. Thank you, Mr. Chairman and members of the committee. I am pleased to serve on the present panel to discuss health effects associated with lead exposure, with emphasis on newly available research findings and research needed to help close gaps in our knowledge.

I am accompanied by Dr. Lester Grant, who is the Director of EPA's Environmental Criteria and Assessment Office. Dr. Grant and his staff have been responsible for agency evaluations of lead health effects in connection with their preparation of a revised criteria document for lead. This will serve as the basis for the congressionally mandated periodic review and, if appropriate, revision of the national ambient air quality standard.

Let me repeat what Assistant Administrator Cannon said before. The criteria document approach is being done because of a periodic review which EPA goes through. It would have been done whether the lead phasedown issue had developed or had not developed.

Lead exposures of children are of particular concern. It's not possible in the time available here to provide a comprehensive review. So what I will try to do is just paraphrase my statement and focus on the most important health information, and particularly new health information.

The most commonly used index of body lead levels is the blood lead. Blood lead is an index of internal exposure. It's not perfect, and it has some drawbacks, but it is nevertheless the most widely used exposure index; and I am going to cite blood lead levels in discussing lead health effects. Just to put things in context, probably the average blood lead level of the people in this room right now is on the level of perhaps 12 micrograms per deciliter.

A key factor in decisionmaking for the national ambient air quality standard process, and also regarding the lead phasedown, has been the definition of a maximum safe blood lead level. In the

1978 standard this was defined based on the evaluation of exposure-effect, or dose-response relationships, contained in the 1977 EPA criteria document for lead.

Major attention focused then on data useful in delineating lowest observed effect levels for two categories of lead-induced health effects: First, home synthesis and hematological effects, and second, central and peripheral nervous system effects.

EPA concluded then that the maximum safe blood lead level for any child was 30 micrograms per deciliter. This again was based, in part, on the identification of young children as the population group most at risk for lead health effects. I might also note that Dr. Houk's group at CDC came out, but for a different purpose, with exactly that same blood lead level.

The health data base concerning lead effects has expanded considerably with the publication of many new findings since the preparation of the 1977 EPA Lead Criteria Document. Reevaluation of earlier available studies and newly emerging data have confirmed EPA's previous conclusions concerning the lowest observed effect levels for blood cell formation and the heme synthesis effects. The degree of concern associated with signs of impaired heme synthesis, detected at levels below 30 micrograms per deciliter, however, is now heightened in view of new evidence of heme synthesis being impaired in other soft tissues, notably the brain and the kidney, possibly in parallel with the blood, as well as other data demonstrating alterations in additional important physiological processes or organ systems, such as effects on vitamin D metabolism and electrophysiological alterations and other signs of effects in the brain.

The determination of credible exposure-effect relationships for nervous system effects, especially those occurring at lower blood levels, has been a subject of much greater discussion and controversy than the blood effects. Reevaluation of earlier available studies and examination of more recently reported analyses concerning the effects of lead on IQ or other neurobehavioral performance measures in nonovertly lead-intoxicated children have thus far led to the conclusion that lead is likely associated with cognitive defects in such children at blood lead levels in excess of 30 micrograms per deciliter.

The available data concerning cognitive and behavioral effects at levels below 30 are much less clear, however, especially in light of rapidly accumulating findings from very recent studies. Some of these latter studies have found no significant associations between lead and IQ, and others have found patterns of effects, although reduced in magnitude compared to higher lead levels, indicating that some effect may occur.

Nerve conduction velocity studies, including some newly available since 1977, are clearly indicative of peripheral nerve dysfunction at blood lead levels as low as 30 to 40 micrograms per deciliter or perhaps somewhat lower.

Of less clear medical significance are certain electrophysiological effects observed in preschool children with blood lead levels ranging from 8 to 30 micrograms per deciliter. These are EPA studies which show that followup of children who were lead-intoxicated at

the age of two still show some, but not all, residual deficits 5 years later.

Other important effects newly demonstrated to be associated with lead exposures starting below 30 micrograms include inhibition of yet another red cell enzyme and, perhaps of greater pathological importance, interference in vitamin D metabolism.

The enzyme effect is observed in children at blood lead levels extending to below 10 micrograms per deciliter. There is a debate as to its medical significance, but there is no apparent threshold that's been discovered for the effect.

The inhibition of vitamin D metabolism demonstrated in children to be associated with blood lead levels extending down, again without apparent threshold, to as low as 12 to 15 micrograms of lead per deciliter in blood, is of particular concern because of the importance of vitamin D metabolism to the kidney, and in terms of growth and development in children.

There are some new findings as well coming out of the National Health and Nutrition Evaluation Survey, which Dr. Houk will discuss in much more detail. Some of these include the suggestion that there may be an association between elevations in adults' blood pressure and levels of blood lead.

Other new findings which were recently discussed in an EPA-sponsored international workshop on prospective studies of pediatric populations might also be mentioned here. They focused on major long-term studies in the United States and abroad concerning effects of lead on the fetus and during early childhood. Among the results reported at that meeting and just recently published were findings of some minor congenital anomalies in newborn infants being associated with umbilical blood lead levels averaging below 10 micrograms per decileter. Dr. Needleman, who is on the panel, has presented these studies, and I am sure he will tell you more about them.

Let me conclude by pointing out that recent evaluations by other EPA offices of costs and benefits associated with further phasedown or total banning of lead in gasoline found net monetary benefits to be associated with decreasing gasoline lead usage. It is important to emphasize that those calculations included monetized estimates only of benefits expected for avoidance of health effects associated with blood lead levels above 30 micrograms per deciliter. If there were no effects at all below 30 micrograms per deciliter, the monetized levels in the EPA studies would still not change.

None of the new types of effects discussed here as being reported at blood lead levels of less than 30 micrograms were monetized, although they are of concern and, of course, provide additional support for reducing lead in gasoline.

Thank you. I will be happy to answer any questions.

Senator STAFFORD. Thank you very much, Doctor.

Since this Senator comes from the same neighborhood where Calvin Coolidge was born and grew up, we make anybody who concludes within their time limit an honorary Northern New Englander.

Dr. Houk, we would be very glad to hear from you.

STATEMENT OF DR. VERNON N. HOUK, DIRECTOR, CENTER FOR ENVIRONMENTAL HEALTH, CENTERS FOR DISEASE CONTROL, PUBLIC HEALTH SERVICE, ACCOMPANIED BY DR. JAMES PIRKLE

Dr. HOUK. Thank you, Mr. Chairman, Senator Durenberger, and Senator Evans. I am Dr. Vernon Houk of the Centers for Disease Control, of the Public Health Service. I am pleased to be here today to discuss an issue that I have been deeply involved in since 1973. I have accompanying me Dr. James Pirkle of my staff, who has done much of the analysis.

Before I begin, I would like to make an aside. In some of the documents of recent days, the relationship between the Environmental Protection Agency and CDC on this issue has been described as "collusion." I would prefer to describe that relationship as two responsible public agencies working for the benefit of the health of the children of the United States.

One of the major advances in the last 10 years has been our improved understanding of the contribution of air lead to the multiple routes of human lead exposure. The three major population-wide sources of lead exposure in the United States are lead in gasoline, lead in paint, and lead in solder. These sources of lead use the pathways of air, water, food, paint chips, dust, and dirt to reach children and adults.

Gasoline lead, which leaves the tailpipe and is temporarily suspended in the air, accounts for about 85 percent of all of the air lead in the United States. Subsequently, it falls from the air onto the water, dust, food crops, and dirt, contaminating drinking water and the food chain. People are then exposed to gasoline lead by breathing, eating, and drinking, and especially children through the normal hand-to-mouth activity that transfers dust and dirt to their mouths.

Several recent studies have investigated the relationship between gasoline lead and blood lead. One nationwide study is the second national health and nutrition assessment survey, which was designed to represent the civilian noninstitutionalized population of the United States 6 months to 74 years of age.

From February 1976 through February 1980, mean blood lead levels in the United States dropped 37 percent, from 15 micrograms to 10 micrograms per deciliter. In addition, the blood lead levels were found to be higher in the summer as compared with the winter.

General exposure to lead in paint and soldered lead in cans changed very little during the survey period. However, lead in gasoline decreased approximately 50 percent over the 4 years of the survey, from 196,000 tons per year to 94,000 tons per year.

Appended at the back of my testimony is a chart, and you don't have to have very much statistical training to review it. Some commonsense will show you that association is very, very strong. It shows the lead used in gasoline and NHANES levels over this survey period.

Mutiple regression analysis revealed that 50-percent decrease in leaded gasoline fully accounted for the 37-percent decline in blood lead levels. In addition, the seasonal fluctuations in blood lead

levels are explained by the seasonal fluctuation in lead gasoline usage. Seasonal fluctuations in blood lead levels have been noted previously, but this is the first time that they have ever been adequately explained.

So the gasoline lead-blood lead relationship that explained the overall 4-year decline in blood lead levels also explained the increase in blood lead levels that occured from the winter to the summer months.

For children 6-month mean blood lead levels were highly correlated with 6-month mean gasoline lead levels. This high correlation did not appreciably change even after accounting for the effects of virtually every conceivable variable that could influence these results. The probability that chance could account for this relationship between blood lead levels and gasoline lead is less than one in 10,000.

The NHANES II blood lead level results also predicted the average length of time that a change in blood lead levels would lag behind the gasoline lead exposure by approximately 1 month. A similar value was determined independently by isotopic measurements.

In addition, the New York City and Chicago lead screening programs have measured the blood lead levels of a large number of children. Analysis of the blood lead levels of New York and Chicago children from 1970 to 1976 showed a strong association between gasoline lead and blood lead. Just as with the NHANES II data, the decline in blood lead levels are explained by gasoline lead usage and also explained the short-term seasonal fluctuations in blood lead.

Another study conducted by Dr. Needleman's group in Boston of umbilical cord blood lead levels between A[illegible] 1979 and April 1981 showed a downward trend and the seasonal pattern of blood lead levels were found. Average monthly mean blood lead levels were strongly associated with the local monthly gasoline usage.

The implication of gasoline lead as a significant contributor to the umbilical cord blood lead levels is noteworthy, since the yet-unborn child is probably the most vulnerable to the neurotoxic effects of lead.

The NHANES II study, the New York City, the Chicago, and the Boston blood lead data are four large independent data sets, each demonstrating the same strong relationship between gasoline lead and children's blood lead levels. In each of these studies, gasoline lead usage not only explained long-term decreases in blood lead levels but simultaneously accounted for the short-term increases in blood lead levels that occur from winter to summer months.

The excellent agreement of these four independent studies strongly supports a causal relationship between changes in gasoline lead use and changes in blood lead.

In an effort to quantify the amount of lead in human blood which comes from gasoline, a large-scale field study was undertaken in Italy in 1974. The gasoline of an entire region in northern Italy was 90 percent replaced with gasoline which contained lead from a foreign source that could be isotopically traced. Gasoline lead was found to contribute at least 5 to 6 micrograms per deciliter to the blood lead levels.

Estimates from the NHANES II are that gasoline lead contributed approximately 8 micrograms per deciliter to the blood lead levels, which is in good agreement with the Italian experiment.

For a typical child in the United States, current gasoline lead exposure accounts for 25 to 50 percent of the total blood lead level. In pockets of excessive lead exposure from gasoline, this contribution is likely to be higher.

Calculations from CDC's lead screening program indicate that if no lead had been allowed in gasoline since 1977, there would have been approximately 80 percent fewer children identified with lead toxicity. That is, 80 percent of the children found to have lead toxicity required the contribution of both gasoline lead and nongasoline lead sources to reach the toxic effects.

Compounding the gasoline lead exposure problem is that the gasoline lead that is dispersed into the environment accumulates. General lead accumulation in our environment from all sources has already amassed to such a degree that the typical adult body burdens of lead in the United States are about 500 times higher than those persons who lived in our preindustrial era. Even though the amount of lead in gasoline has been reduced, as of the beginning of 1984, lead is still being dispersed into the United States environment at a rate of 53,000 tons per year, or 6.1 tons per hour, an unnecessary contamination of our environment by a very highly toxic material that has been demonstrated to have adverse effects on humans.

In summary, in spite of some other views which you may hear this morning—and I predict you will hear other views—evidence is overwhelming that the gasoline lead is a major controllable source of lead exposure. Eliminating lead in gasoline would not only immediately decrease the blood lead levels, but would also decrease the background lead levels for future generations.

Thank you very much.

Senator STAFFORD. Thank you very much, Doctor.

And now we would be pleased to hear from Dr. Needleman.

STATEMENT OF DR. HERBERT L. NEEDLEMAN, DIRECTOR, BEHAVIORAL SCIENCES DIVISION, CHILDREN'S HOSPITAL OF PITTSBURGH

Dr. NEEDLEMAN. Good morning, Mr. Chairman. I am Herbert L. Needleman. I am chief of psychiatry at the Children's Hospital of Pittsburgh. I am also a pediatrician, and I believe that I may be the only witness here today who has actually treated lead poisoning. So I speak about my research and the research of others from the vantage of somebody who has had to deal with the acute consequences of lead intoxication and the remedial education of children who are brain-damaged as a result of their exposure.

I want to congratulate this committee and Senator Durenberger for taking the leadership in what I think is one of the most important public health issues of the decade for American children.

I will not read my testimony because of time. I gather my assignment is to review in capsule form the health effects of lead at low dose. I will concentrate on the work of my group, but I don't want to convey that the burden of the evidence resides just with the

studies we have done. I simply know them the best. There is a convergence of inference on the basis of most health scientists that lead at low dose is toxic. The great exception to that covergence comes from the lead industry and its surrogates in the academy who are sponsored by them.

Now let me turn to the issue of epidemiologic studies of lead at low dose. I treated a lot of lead poisonings as a resident in pediatrics in Philadelphia, and when I went into community psychiatry in the late 1960's, I spoke to principals, school teachers in the inner city of Philadelphia and found that the most vexing problems for them were children who were behavior-disordered, learning-disabled, or mentally retarded. And parents reported the same concerns.

It seemed to me that since this was the same area in which lead exposure was endemic, perhaps some of this was related to a preventable exposure to a poison. Forty years ago, my mentor, Dr. Randolph Byers, a neurologist for the Boston Children's Hospital, had followed up 20 children who had recovered from lead poisoning, and found that 19 out of 20 had severe behavior disorders or learning disabilities.

In 1943 Dr. Byers asked, "How many children in the city who are learning-disabled are that way because of exposure to lead?" That was a prophetic question that we have been struggling to answer ever since.

In order to look back in the history of exposure to children with lead, because blood lead is the short-term storage system, I developed a new method, lead storage in deciduous teeth. We collect a lot of baby teeth. It turned out that the tooth was in fact a very good marker for past exposure.

I went to Boston then to see if this classifier would enable us to see if differential exposure made any difference in children's functions. I will tell you quickly about that study.

We collected teeth from about 2,000 children in Summerville and Chelsea, MA, classified them according to the amount of lead in their teeth, brought in children with the highest and the lowest lead into the Boston Children's Hospital, examined a large number of non-lead covariates which could affect development: socioeconomic status, mother's IQ, et cetera. Controlling for those, we evaluated children's psychologic performance under blind conditions. My research assistants did not know the children's lead levels.

And when we then corrected for all the covariates which did differ between exposure, we found that children with high lead in their teeth, all of whom were diagnosed by society as normal enough to attend ordinary first and second grade, had a mean IQ difference 4 points below those with low lead in their teeth. None of these children had diagnoses of lead poisoning.

Now, the lead industry has said, "Well, 4 points is not a very big difference." But if you plot the actual distribution of differences, a 4-point shift in the mean predicts a fourfold increase in the percentage of children with severe deficits.

On the handout there is a graph that depicts this that was published in the New England Journal of Medicine.

We see that moving the mean a small amount down quadruples the amount of children with severe deficits.

In addition, we asked teachers, who also did not know the children's lead levels, to evaluate the kids on 11 yes or no items: Is the child distractable, yes or no; is the child able to persist at his work; is the child hyperactive, et cetera.

When we plotted dentine lead levels against the proportion of bad scores on each one of those items, there was a regular smooth increase in bad scores, step by step, with the increase in lead levels.

So something was going on in the classroom which affected behavior, and was recognized by the teachers, which was directly correlated with dentine lead levels.

This study received a lot of attention, and a great deal of skepticism. Bill Yule, who is a psychologist in London, was funded by the Medical Research Council to disprove this. He admits that. He found the same thing in English school children, using the same scale. This finding doesn't depend purely on my own work.

Now, this is an issue which has gathered a great deal of controversy. The bulk of the conclusions from pediatricians and public health authorities is that lead at doses below those which bring children to the hospital is associated with impaired mental function.

The lead industry and certain of their academic consultants have raised canons for proof in epideniologic studies of lead which are impossible to fulfill in real-world investigations. In this regard, their behavior resembles that of the tobacco industry, which still maintains in the face of overwhelming evidence that the health case against smoking is unproved. The parallels are extraordinary.

Now, school-age children may not be the most sensitive target group. Lead crosses the placenta. A good friend of mine, Dr. Jack Scanlon, in 1972 measured umbilical cord blood lead—which is infant's blood, by the way—and showed in a small Boston sample that suburban children, infants of suburban mothers, had lower umbilical cord blood lead levels than urban mothers.

We collected, as Dr. Houk and Dr. Goldstein indicated, 12,000 umbilical cord blood leads from BH Hospital women in over 2 years. We measured the monthly mean umbilical cord blood lead and from proprietary sources got the total sales of alkyl gasoline in Massachusetts. The correlation between the decrease over those 2 years month-by-month was 0.75. A perfect correlation would be 0.1; no correlation would be zero. The coefficient of determination for amount of lead in umbilical cord blood is 50 percent. That study which was published in Lancet in 1983.

We then took 5,000 mother-infant pairs, and on the first day after birth we asked the mother a large series of questions about past medical history, alcohol, tobacco use, et cetera, and looked at a number of birth outcomes. In last week's Journal of the American Medical Association, we published an article which showed that the incidence of minor malformations, none of which are compromising to the baby's health, increases in dose-dependent fashion in relation to the amount of lead in the umbilical-cord blood, controlling for all the other covariates in the model which could affect malformation.

The mean umbilical cord blood lead in that sample was 6.7 micrograms per deciliter. As you go from the lowest you can measure

to the median, the risk for minor malformations almost doubles. And as you go to the 98.8 percentile, it almost triples.

So lead may be involved, as it has been demonstrated in animals, in affecting the developmental program.

We have also followed forward from that group of individuals 250 children and seen them at every 6-month intervals, and we're measuring their development. And in an article which has been accepted for publication, we demonstrate, controlling for 120 nonlead covariates, that umbilical-cord-blood lead predicts infant IQ as measured by Bailey scales at 6 and 12 months of age.

So it may be that a determinant of infant outcome at 6 and 12 months of age is established by lead exposures while the fetus is in utero. That corresponds very nicely with animal studies conducted over the last 15 years.

In summary, I think a prudent and neutral evaluator of the body of data, not just my own group's, could not escape the conclusion that low-dose effects of lead affect children's brains and forward studies of lead show an effect on the development and the incidence of minor malformation.

I think the larger mystery here is why our society has been so slow to recognize this threat—it's been 40 years since Dr. Byers' paper in the American Journal of Disease in Children—and why it's so slow to deal with it effectively and promptly.

I congratulate you and the committee, sir, for seizing the leadership on this vital public health problem and would be prepared to answer your questions.

Senator STAFFORD. Thank you, Doctor.

Now Dr. Cole.

STATEMENT OF DR. JEROME F. COLE, PRESIDENT, INTERNATIONAL LEAD ZINC RESEARCH ORGANIZATION, INC., ACCOMPANIED BY DR. ROBERT BORNSCHEIN, ASSOCIATE PROFESSOR, UNIVERSITY OF CINCINNATI

Dr. COLE. Thank you, Senator. My name is Jerome F. Cole. I am president of the International Lead Zinc Research Organization, and I am appearing here today at the request of the Lead Industries Association, which is the trade association for the lead industry in the United States. With me is a consultant to ILZRO, Dr. Robert Bornschein. Dr. Bornschein is a researcher, an expert on studies pertaining to neurobehavioral effects of lead. He is an associate professor at the University of Cincinnati and is very familiar with the scientific studies pertaining to the neurobehavioral effects that Dr. Needleman was referring to. He is here to answer any questions that you may have. He is also prepared to answer any questions regarding the current ongoing prospective studies which were the subject of the EPA-sponsored meeting in Cincinnati that was referred to earlier by Dr. Goldstein, and also of course his own work, which is a very large study being sponsored by the U.S. National Institutes of Environmental Health Sciences.

The research that ILZRO, our organization, and others have conducted indicate that lead that has been used in paint in the past and is still present in old deteriorating housing is far and away the primary cause of elevated blood lead levels in children.

Frankly, we think that over the past decade the Government has been shooting at the wrong target when they have been so active in attempting to get the lead out of gasoline. Lead has been used in gasoline for over 60 years. Over that time, despite extensive research efforts on the part of industry, and academia, and the Government, there is simply no evidence that anyone in the general public has ever been harmed by this usage.

We are aware, of course, of the claims and the arguments of those who would further restrict or ban the use of lead in gasoline. These generally include an inflated estimate of the contribution of leaded gasoline to lead absorption as measured by the lead content in blood, and further, a onesided, and I think an alarmist, view of the medical and health evidence pertaining to the impact of low-level-lead exposure.

Over the years there have been a number of studies that have attempted to estimate the contribution of leaded gasoline to lead in blood. Virtually none of these studies have been definitive. However, a picture has emerged which is fairly consistent; and that is that the contribution of leaded gasoline to lead in blood is relatively small.

The most recent thorough review of this issue was carried out by Dr. Peter Elwood of the U.K. Medical Research Council epidemiology unit in Cardiff, Wales. And I have attached a copy of Dr. Elwood's review to my statement, and I would hope that it would be included as well.[1]

Dr. Elwood's conclusion is that while it is impossible to make a reasonable estimate of the total contribution of gasoline lead to blood lead, all the studies put together indicate that both from air and other routes of exposure, the contribution of gasoline lead is small.

I should also point out at this stage that Dr. Elwood is not alone in that view. Others have also indicated that the contribution of lead in gasoline is relatively small. In fact, a study that was carried out in Dallas—there has been a large lead controversy going on in Dallas—back in 1982, and I believe Dr. Houk was a part of that, indicated that in areas of heavy traffic, the contribution of lead in gasoline, as indicated by traffic density, was 1 microgram per deciliter. That's considerably lower than the levels that he was talking about here earlier today based on the NHANES II data.

We have heard a lot about the NHANES II data and the correlation between the reduction of lead in gasoline and lead in blood over the same period, 1976 to 1980. It's true, of course, that lead in gasoline was reduced over that period of time and so did blood leads come down over that same period of time.

However, to suggest that all, or even most, of the decline in blood lead was caused simply by a reduction of lead in gasoline is, in our view, simplistic and dangerous. I think it's simplistic because the analysis ignores the impact of other, concurrent private and governmental initiatives. In fact, there are some 14 governmental regulations on the books right now that require control of lead in the environment.

---

[1] Retained in committee files.

It's also dangerous because by erroneously attributing so much of the contribution of lead in blood to one source, it tends to endanger other programs which are far more meaningful in terms of reducing the likelihood of lead poisoning in children.

Just recently, the Department of Housing and Urban Development came out with a proposal that would weaken their abatement effort in cleaning up old-lead-based paint in housing, and the basis for that was the analysis of the NHANES data which Dr. Houk mentioned earlier.

We would refer you once again to the report by Dr. Elwood for specific criticisms of the NHANES II data. But we would also ask you to review the report which I have also included with my statement, which was from an independent peer review group which was gathered at the request of the U.S. Environmental Protection Agency.

This NHANES II time trend analysis review group reviewed the analysis from a statistical standpoint. While in a narrow sense the review group confirmed the correlation that Dr. Houk mentioned earlier, it did point out several weaknesses in the analysis.

Also—and I think this is very important because of what we heard earlier—the group strongly warned against using the NHANES II data for estimates of the impact of gasoline lead on blood lead beyond the limits of the data, beyond 1980, which was the last year of the data. And yet, that's precisely what the EPA Office of Policy Analysis has done when it used the NHANES II data to predict the blood-lead levels of children in 1988 in its draft final report on the costs and benefits. They have used those, they have monetized those supposed benefits, and it's a clear violation of the recommendations of the EPA-appointed peer review group.

Therefore, we believe that reliable data show that lead in gasoline is a minor source of lead in blood. We recognize, however, that there are those who claim that even at low levels of lead in blood, there are adverse health effects. The most provocative and alarming of these claims is that low-level-lead exposure is associated with behavioral effects and learning disabilities.

The work of Dr. Neeleman here is most often cited as the support for this premise. His study, which has been controversial from the beginning, was published in 1979 and has received an enormous amount of publicity and accounts for the general perception that low-level-lead exposure is harmful.

However, in 1983, late 1983, EPA also appointed another independent peer review committee to review Dr. Needleman's work and also the work of Dr. Ernhart. They were critical of both studies. In addition, the committee examined several studies, one of which was referred to—by Dr. Needleman.

But regarding his study, the committee concluded that because of errors in analysis, the Needleman paper neither supports nor refutes the hypothesis that low or moderate levels of lead exposure lead to cognitive or other behavioral impairments in children.

The committee also reviewed all the other studies and concluded, finally, that the committee knew of no studies that to date have validly established, after proper control for confounding variables, a relationship between low-level-lead exposure and neuropsychologic deficits in children.

The lesson that we should learn from this is that just getting a paper in print does not mean that it's gospel. Most recently, Dr. Needleman has commented on his paper in the Journal of the American Medical Association, and that has been referenced here today. And I would only note that at the recent Clean Air Science Advisory Committee, Dr. Julian Chisolm, who is an expert on pediatric lead poisoning, recommended that this paper be submitted to competent geneticists and teratologists for very cautious review because, and I quote: "I don't think that it was particularly * * * when it was originally presented that it was very well received."

The EPA peer review process that has been carried out on several controversial issues in the preparation of the new ambient air quality criteria document I think has been very valuable for clarifying the real meaning, or lack of meaning, of particularly controversial studies. We would urge that this process be extended to other studies before they're accepted at face value.

To assume a priori that minor biochemical changes are harmful would, if adopted as a general policy, open a floodgate of unnecessary regulations on virtually every substance in our environment. Quite simply, we don't think that the scientific and medical data at hand warrant the further reduction of the lead content in gasoline. And those who claim that they do, I believe, are engaging in improper scientific extrapolation.

At the outset, Senator Durenberger quoted Benjamin Franklin. I, at the end of my prepared statement, quoted from Mark Twain. And I would ask you to read it.

But in conclusion, I think the point that I would like to make is, in quoting from Mark Twain: "One gets such wholesale returns of conjecture out of such trifling investment of fact." And I think that unfortunately has been the case with much of what has been said in the past and here today about lead in gasoline.

Thank you.

Senator STAFFORD. Thank you, Dr. Cole.

We will, without objection, incorporate the various documents attached to your statement in the record by reference.

Now, we don't want to invite a general and lengthy debate in view of the number of witnesses yet to be heard. But might I ask members of the panel if any of you wish to briefly respond to the comments of any other member of the panel?

Dr. Houk.

Dr. HOUK. The documents that are being submitted as part of Dr. Cole's statement are clearly from a draft document prepared by EPA that says on its cover: "Not for distribution. Do not cite," and has not necessarily been accepted by the CASAC yet.

Dr. Cole in his statement has a half quote about the cause and causality of the NHANES II data. I think if you read the entire thing, that you will see that is taken out of context.

Epidemiologic studies, Senator, never prove conclusively cause and effect. They determine associations where they exist, remove as many confounders as is possible, so that reasonable people can make reasonable decisions.

The only way to prove cause and effect of blood lead in children's lead level and air-lead-blood level is to take children and put them in a breathing chamber and have them breathe air with different

lead levels. And fortunately, we live in a society where that sort of experimentation is not possible.

Senator STAFFORD. Is there any further comment from anybody. Dr. Cole.

Dr. COLE. I just might respond briefly, sir. The documents that I included have been circulated very widely by the U.S. Environmental Protection Agency all over this country and all over the world. I don't think that there is anything at all secret about them.

Finally, the peer review group on NHANES II data did in fact stress the lack of proof of causality. They also said that they could not necessarily accept the assumptions that there were not other factors involved in the reduction of lead in blood over the same period of lead in gasoline; they simply didn't have the data that would enable them to make such a judgment.

Senator STAFFORD. Thank you.

Dr. Needleman.

Dr. NEEDLEMAN. Just to respond to Dr. Cole's statement about the ECAO appendix that he quoted commenting on my work and Dr. Ernhardt's. He's not really up to date. At the CASAC meeting referred to by Dr. Goldstein, I responded to every one of the questions raised by this review panel, and the Clean Air Science Advisory Committee they advised ECAO that there was no need for this appendix anymore, that my responses had been adequate.

So Dr. Cole is relying on an unpublished report that has not been accepted by EPA.

Senator STAFFORD. Now, Dr. Goldstein, please.

Dr. GOLDSTEIN. Thank you, Senator.

Let me see if I can put into perspective the CASAC, Clean Air Scientific Advisory Committee, process. Dr. Cole has mentioned two of the documents that have been developed as part of our criteria document processes, which are review of the entire literature. But the peer review process that EPA depends upon in its decisionmaking is really that by the Clean Air Scientific Advisory Committee. These are, in a sense, documents which are being reviewed by the Clean Air Scientific Advisory Committee. They do not represent the peer review that we are concerned with, and that will be formally done through with the Clean Air Scientific Advisory Committee.

Perhaps I could just briefly sum up some of my other disagreements with Dr. Cole by agreeing with him on his depiction of Dr. Julian Chisolm as being one of the leading experts in the treatment of lead poisoning in children and knowledge about lead poisoning in children, and point out to you that Dr. Chisolm has just reviewed the evidence and has recommended, along with other people in the field, that the level, the action level for blood leads be dropped from 30 to 25 micrograms per deciliter.

So obviously, he finds compelling some degree of the evidence for effects below 30 micrograms per deciliter.

Senator STAFFORD. Dr. Houk, did you want to speak further?

Dr. HOUK. Senator Stafford, I have been before this committee many times in the past discussing the issue of dioxins, trichlorethylene, ethylene dibromide, and other chemicals. We make public health assessments concerning these chemicals generally on the basis of animal toxicologic studies. We feed animals large doses of a

chemical. Then we extrapolate the effects on that animal of low doses of that chemical. We then extrapolate that information to the human population, and then we add a safety factor of 10, or 100, or 1,000 in making our recommendations.

What we are talking about here on lead is observed adverse health effects in people. We don't have to have high-dose feedings, and all this extrapolation. This is observed.

Lead is also an equal opportunity toxin, if you wish; virtually everybody in the United States is exposed to it through its sources. It is a very highly pervasive toxic material that is now in our environment. It has probably contaminated more people at more hazardous levels than even cigarette smoke.

There is no room for uninformed debate on the issue. The reasonable debate now occurring is: at what levels below 30 do these effects occur? If one says an abnormality on a laboratory test or a physiologic abnormality is not a real health concern, as a physician I would suggest that if I had some abnormal electrical activity of my heart measured on electrocardiogram, in which I felt no chest pain, I still would consider that I have heart disease and potential for having a myocardial infarction.

Thank you.

Senator STAFFORD. Is there further discussion?

Dr. Cole.

Dr. COLE. Mr. Chairman, I think that the issue here is probably not going to be resolved in—by just simple statements of belief, which I believe is what Dr. Houk has brought forward. I think a thorough examination of the data, such as I have suggested, is the only way that one can actually reach conclusions regarding the validity of studies which impact upon this issue.

However, just so you know that I am not particularly by myself, even though perhaps on this panel I find myself in that way and on some other panels from time to time, recently, Dr. Halpin, director of parental and child health services of the State of New Jersey, made a statement to the Centers for Disease Control, and I quote: "Lowering the definition of lead poisoning from 30 to 25 should only be done with the general agreement of the pediatric community. Currently, such support does not seem to exist."

Therefore, I am not alone, sir.

Senator STAFFORD. Thank you all very much.

Senator Durenberger.

Senator DURENBERGER. Yes, Mr. Chairman. I will try to be brief.

I want to start by thanking Dr. Needleman for his comments and to indicate that as a trustee of another children's hospital in this country I have always admired both Pittsburgh and Boston for their particular contributions, but then to say something on behalf of children's health centers across this country as they have grown in their specialties from the days when children's hospitals were crippled children's hospitals, largely, to the point in time where as an institution it seems to me that children's health centers and hospitals in this country are making some enormous contributions to our understanding of the variety of health effects that society and America has on our children.

It isn't only the publicity-generating, frontier-breaking activities of your liver transplant units, but I would say probably, as you

look at a lot of children's health centers in this country, it's what they are doing in the area of prevention and the area of mental health which is your expertise. And obviously, this is an area in which, as everyone has said, it's very difficult for us to dot the i's and cross the t's.

But I just want to say to you that I am, while I have seen Dr. Houk here many, many times, as he indicated earlier, and Dr. Goldstein has been in front of our subcommittee a number of times, I think that some pediatricians may disagree with the thesis that is offered here today, there is little doubt in my mind that Dr. Needleman and the experience that he has indicated to us that he has and that I think comes from a variety of people that I know associated with pediatric health care, at least in the mind of one member of this committee carries a great deal of weight. And I am not about to put them on a scale and find out how many pediatricians are on this side and how many pediatricians are on the other side.

Wednesday of this week I chaired a hearing on maternal and child health and the future of that effort that the Government has been helping society make, and I know the variety of concerns that are expressed in this country.

One of the issues that came up since we have blocked maternal and child health moneys was the fact that moneys formerly categorically granted for lead-paint poisoning seemed to be declining in their utilization, while others, particularly the pregnancy-prevention programs, prenatal- and postpartum-health-care activities are increasing.

But just on this whole issue that Dr. Cole raised of how much of the problem comes out of tailpipes and how much of it comes out of Tom Sawyer's paintbrush, would anybody want to contradict what Dr. Cole said relative to lead paint poisoning versus tailpipe poisoning?

Dr. NEEDLEMAN. Thank you for your comments, sir.

I don't want to contradict Dr. Cole. I just want to say that one of the reasons that there has been this paralysis in dealing with this is that the problem of lead has been passed around like a dirty relative. The lead additive industry would say it's old paint. HUD, because they don't want to bite the bullet on billions of dollars to delead houses, says it's lead in the atmosphere. The paint industry says, "Yes, it may be paint, but it's paint that's already sold 50 years ago," and nobody will say, "Well, it may be all of these things, and let's have a directed sequential approach as we do with medical problems."

If somebody comes in with four problems, you take them each individually and then attempt to remedy it.

Lead in the atmosphere, lead emissions deserves attention. Lead in housing deserves attention. And it's time to stop saying it's either this or that.

Senator DURENBERGER. Dr. Houk.

Dr. HOUK. The high-dose sources of lead in this country, Senator, are lead in paint, lead in dust and soil. The lead in the dust in soil gets there from lead in paint, lead from the deposition of automobile emissions and other emissions and previous land use.

It is quite correct to say that lead paint is probably the major cause of overt lead poisoning in this country. Children who have blood leads in the eighties and the sixties, who are overtly poisoned, and have encephalopathy and die, usually one can x ray their abdomen and find paint chips.

We are not dealing with that issue—although that is a very important issue, and the height of that issue has been, I believe, rather successfully dealt with in the lead-paint-poisoning program. There is still a lot of lead in houses, and that needs to be addressed, and I choose to address those with equal vigor as I address the gasoline issue, be that landlord a governmental agency or a private entity.

But we have a source of lead in this country of around 8 micrograms that is from the air. It is a controllable source. We can now adequately control the amount of lead used in gasoline. We cannot as a country afford at this point to right now remove all of the lead paint from the interior and the exterior of 50 million homes. We can prevent the lead in gasoline at this particular point.

There are no safety factors in this issue. Let's say, for example, that we all agree that lead causes nothing below 30 and only above 30. Well, establishing a level of concern of 30 has absolutely no safety factor.

Children who have blood leads of 80 are at very high risk of dying. I think we would all agree that death is an adverse health effect. If we used our usual procedure of putting in even a tenfold safety factor, then we would regulate the blood lead down to 8 micrograms. The mean blood-lead levels of the children in this country are substantially higher than that. So even if we had a tenfold safety factor from death, we are in excess of that safety factor for the majority of our population.

Senator DURENBERGER. Dr. Goldstein, the lead criteria study discusses the ability of lead particulate to stay airborne and travel great distances. Can you give us some information on how far it can travel before it comes to Earth as dust?

Dr. GOLDSTEIN. Dr. Grant is here with me and has reviewed that data more extensively than I have.

Dr. GRANT. Emissions from automobiles in heavily trafficked areas do carry out to within several hundred yards or whatever of the roadside and so on and are deposited there, primarily within about that area.

It can, or some may travel further. In cities, certainly with heavy-density traffic and on major highways or whatever, intersections of Interstates and so forth of this sort of thing, there can be quite considerable deposition in the surrounding areas.

Senator DURENBERGER. Dr. Goldstein, we're going to have a witness later this morning who will say something like the following: "The EPA expert committee of pediatric neural behavioral evaluations has recently concluded that the committee knows of no studies that to date have validly established a relationship between low-level lead exposure and neuropsychological effects in children."

He is going to be quoting from an EPA-sponsored statement. I wonder if you could shed some light on that for us?

Dr. GOLDSTEIN. Well, again, there, as part of EPA's criteria document approach we have developed—Dr. Grant has been very much

involved in this—an approach which says: "Well, let's take a much more close look at potentially controversial and important areas which the Administrator will eventually have to make decisions."

As part of doing that, we bring in expert panels to give us some advice. However, these are advice which are preliminary to the overall peer review, which is the congressionally mandated Clean Air Scientific Advisory Committee. They have not come to a judgment as of yet on any of these, whether it be the statement you have quoted or any of the others. They are in the process of meeting, and they will meet again, I believe, in September through this usual process.

Let me again state that this is independent in its, at least legislative mandate in the lead phasedown, that again if there were no—if Dr. Needleman's data is to be thrown out by the scientific body that will be reviewing it, there still would not be one penny difference to the currently monetized level for a net benefit to society of removing lead from gasoline as part of the lead phasedown document.

You will be hearing more about that from some of the other later EPA witnesses. So those, I think, would be the two major comments I would make.

Senator DURENBERGER. Mr. Chairman, I have a series of other questions I won't take the time for today, but I would like to submit in writing.

Senator STAFFORD. I think the Chair, if there is no objection, will reserve the right to all members of the committee to submit questions in writing for you to answer them at your early convenience. Is that agreeable?

I see you are all nodding affirmatively. All right, we will maybe save some time that way.

Senator Evans.

Senator EVANS. Dr. Goldstein, could you review, in layman's terms, the adverse effects on children and on adults that you have identified fron excess levels of lead in the blood?

Dr. GOLDSTEIN. Well, when one, obviously, the major adverse effect, as Dr. Houk has pointed out, is death. In children, this is unfortunately still quite common.

Senator EVANS. That is an adverse effect.

Dr. GOLDSTEIN. And death occurs through central nervous system effects. It occurs at blood-lead levels of, say, perhaps 80 micrograms per deciliter. One still sees central-nervous-system effects of less than death. One sees children in coma who recover. One sees children who recover partially, at least. One sees children who obviously have been gravely affected by central-nervous-system damage due to lead. And as one gets to lower and lower lead levels, the effects become less apparent.

And what you have heard is a debate this morning as to what levels you finally stop seeing effects. Can you actually see effects down to the levels that we have in our bodies, we the people in this room, or is it somewhat above that?

And these effects would be the more subtle effects on IQ and other neurobehavioral type of performance effects, perhaps hyperirritability of children. This is the level of central-nervous-system effects. And there are effects on other organ systems. The classic

one is the effect on blood. There is no question, very high levels of lead produce anemia, and one gets to see lesser levels of anemia as the blood-lead levels go down until one can start seeing effects on blood cells without really seeing anemia. And again, the levels of effects of effects on blood cells seem now to be down to again levels that we have in our bodies, and everyone can start seeing small effects.

How important they are is a matter of debate, but nevertheless, the effects occur.

There are effects on other organs as well. I will shorten this up by saying that there is one new piece of information, one new body of science that really hasn't been discussed today. And that's the fact that the effect of lead on the blood occurs through altering the ability of the blood to make that which changes the blood to a red color, something called heme. What has happened in the past decade or so is that scientists have come to recognize that heme is present not only in red blood cells but is a very important part of every organ system of every cellular process.

And so it makes more sense that lead would produce effects in many different organs besides those effects in the blood.

Senator EVANS. In the adult population, primarily high blood pressure?

Dr. GOLDSTEIN. Well, the adult population, I will argue with my friend, Dr. Needleman—and I have taken care of patients as well, but only adult patients, with lead poisoning—in the adult population one tends to see peripheral nervous-system-effects. They cannot use their hands and feet. There is an association with gout, association with kidney disease, and more recently, a suggestion that even at very low blood-lead levels there is an effect on high blood pressure in increasing blood pressure.

Senator EVANS. If you remove lead from the atmosphere or from any ingestion from whatever source to either children or adults, do the levels of lead in the blood or in the body reduces, or is it permanent?

Dr. GOLDSTEIN. No, the blood levels will reduce.

Senator EVANS. All right. Along with that, will the adverse effects tend to reduce as well?

Dr. GOLDSTEIN. The blood adverse effects, the effects on anemia will reduce. The central nervous system effects will to some extent appear to be irreversible, certainly in those children who have been severely affected.

More recently, an EPA-sponsored study seems to show that some of these central nervous system effects that are detected by using brainwave studies do persist for at least a few years after the initial lead poisoning, and this is at blood lead levels around 30 micrograms per deciliter. So it's not overt poisoning.

Senator EVANS. Go ahead, Dr. Houk.

Dr. HOUK. Senator, I think it's important also to answer the question or to recognize the effect upon adults has to be separated between adult men and adult women, because the major effect upon adult women is the effect upon the fetus which may occur at very much lower levels than would affect her as an adult individual.

Senator EVANS. I can't help but comment, Mr. Chairman, that the association of high blood-lead levels with IQ may lead to a new use on the Senate floor in referring to my lead-soaked colleagues.

Dr. Cole, did you want to comment?

Dr. COLE. Yes, sir. I just wanted to comment on the study concerning high blood pressure, hypertension, and blood lead. And this is a typical example of what I was trying to get at before. This study has not been published as yet. It has not been reviewed generally by the medical community. And yet here today we are hearing all about it, and I am sure that it might even make the press tomorrow.

But I would caution you to not just accept that this is the case a priori; as I said, it needs to have further evaluation. Any study like this needs to have further evaluation by scientists that are familiar with hypertension, with the statistical analysis, and all the other factors that went into the study.

Senator EVANS. Dr. Cole, do you have any doubt at all of the adverse effects—and let's take children for the moment—with excessive levels of lead in their body?

Dr. COLE. I am sorry, what was your example, Senator?

Senator EVANS. Do you have any doubt that there is an adverse effect from excessive levels of lead in the blood of children?

Dr. COLE. Oh, absolutely not. At high levels of lead in blood, clearly there is an association with illness.

Senator EVANS. It seems to me that 25 or 30 years after we got started on the association of lung cancer with smoking and cigarettes, we still have many in the tobacco industry suggesting that there is no proven relationship. I don't know how far we have to go before we feel that there is some relationship that at least on a statistical base is worth responding to.

Dr. COLE. Senator, I certainly don't want to argue the tobacco industry's case, by any stretch. But I am familiar with the lead literature, and I do know that there is an effect at elevated blood-lead levels, and in fact, I testified years ago before a Senate committee when the Congress was considering the Lead Paint Poisoning Prevention Act and supported it strongly. And my organization supported it strongly, just in order to make progress against pediatric lead poisoning.

Senator EVANS. How long has it been since there has been lead in paint?

Dr. COLE. Well, most of the lead was taken out of paint voluntarily by the industry back in the fifties. However, there still was some used up until the early seventies.

Senator EVANS. It seems to me that there is an easy way to determine the relative ingestion of lead through paint, and through the atmosphere, and through other sources. I get this mental picture of children gnawing at the walls and at the bed as opposed to breathing, and it just seems to me that the one is a lot more common than the other.

But do we have any factual data a new community, for instance, where there obviously is no lead in the paint in homes, but it may be a community that's in an urban area; has any testing been done on the blood-lead levels of children in those areas? It seems to me that's a pretty easy way to sort out such a question.

Dr. COLE. Dr. Bornschein, of the University of Cincinnati, is carrying out just such a study now.

Senator EVANS. But hasn't completed it?

Dr. COLE. No.

Senator EVANS. All right.

Dr. Houk.

Dr. HOUK. In the NHANES study, Senator, the lowest risk group of children were rural children of affluent white people. And they had a rate of blood leads above 30 of 700 per 100,000. One of the errors that we use is talking in terms of percentages. As Senator Durenberger well knows, on the child committees, we normally talk in terms of disease rates per 100,000. And 700 per 100,000 is not an inconsequential rate. It compares to the urban black child in low family income in the center part of our cities of 18,600 per 100,000. There is no doubt that lead-paint chips, eating lead-paint chips, that mouthing lead from around the windowsill and the doorsill is probably the major cause of significant overt lead encephalopathy, overt lead poisoning in this country.

I might point out, however, that from eating lead-paint chip all the way down to just getting the dust from leaded paint, if we had not added already 8 micrograms through the gasoline route—and the studies that I gave today very clearly demonstrate that, and are backed up by the Italian experiment, which incidentally was partially funded by the lead industry—that if we hadn't had that, that our children could have had more of the high-dose source before their lead levels reached dangerous levels.

We cannot—we do not have the technology, we do not have the ability, we probably don't have the money, to remove the lead from all of the interiors and exteriors of our housing right now. We do have the ability to remove lead from controllable sources, however.

Senator STAFFORD. Senator Evans, I saw Dr. Needleman have his hand up for some time.

Senator EVANS. Well, I just wanted to go back to your testimony, Dr. Houk. And what you're saying, or said in your testimony, is that if there had been no lead in gasoline fron seventy-seven through eighty-one, there would have been approximately 80 percent fewer cases of lead toxicity during that time period?

Dr. HOUK. That's right. And we were finding, of the children screened, lead toxicity of about 6,000 per 100,000, 6 percent, during those screening days. So it.s not an inconsequential number.

Senator EVANS. Dr. Needleman.

Dr. NEEDLEMAN. Yes, sir; when we conpared the tooth-lead levels from lead-poisoned children and inner-city children, children from suburban Boston where my kids went to school, we found that there was a substantial decrease in suburban Boston children. But when we compared those children to children from a small village in Iceland, they had much higher—the children from suburban Boston had much higher levels than children from areas where there were no autonobiles at all.

The inference is that these children who came from good houses in Woburn, MA, were experiencing lead from the vehicular traffic and dust in the environs.

If I can add one other piece for your troubled conjecture about potential adult effects, 95 percent of the lead in your body and

mine is in the bone. And it is relatively fixed there. But as we get older, our bone demineralizes, and I have been worried about what happens to that lead as we get into our sixth and seventh decade. It has to go someplace, and one of the questions I have been asking myself is how much of the disordered memory and mentation of older people may be due to preventable remobilization of a neurotoxin that was locked in for a while.

Senator EVANS. Dr. Cole, you said in your testimony some quite specific things. I am wondering if you are willing to stand by those in light of the testimony of Dr. Houk and the interchange we just had on the 80 percent of children with lead toxicity that were related to lead in the air.

When you said that lead has been used in gasoline for over 60 years, there is no evidence that anyone in the general public has been harmed by this usage, and in short, there has never been evidence that we had a problem with the use of leaded gasoline.

Dr. COLE. Yes, sir, I would still stand by that.

Dr. Houk, in extrapolating backwards from the NHANES data, has done exactly what the statisticians have said should not be done with those data. And therefore, I would hold that his extrapolation as to how many blood leads would presumably have been reduced had lead not been used in gasoline is completely without support.

Senator EVANS. Do you suggest that the lead in gasoline has no adverse effect whatsoever on the health of people?

Dr. COLE. I believe that that is the case, sir. There has never been a case of any kind of illness that has been attributed to the use of lead in gasoline in the general population. And that includes children and adults in the general population. I am excluding, of course, occupational exposure of people working with the compound in a factory.

Senator EVANS. So your testimony is that we should go full bore on the use of leaded gasoline and that the current requirements for unleaded gasoline are just a bunch of poppycock?

Dr. COLE. Well, sir, I believe that there would undoubtedly have come a time, had lead not been controlled to some degree, there might have come a time when there might have been an adverse effect. However, considering the fact that over 70 percent of the lead in gasoline has been removed, I don't think that's likely to occur very soon. And in fact, at the time when all of it was being used, there was no evidence of any adverse health effect.

Senator EVANS. It seems to me that you should be here objecting to the use of unleaded gasoline, certainly on behalf of your industry. You would sell a lot more lead if all of the gasoline was leaded. Since there are no adverse effects, why aren't you advocating that we drop the whole idea of unleaded gasoline?

Dr. COLE. Well, I believe, quite frankly, that you should have some control. I think the controls have gone too far.

Senator EVANS. Well, why should you have any control if you said that there is no evidence that anyone in 60 years has been harmed by the substance?

Dr. COLE. Well, that's correct.

Senator EVANS. Then why do you have controls?

Dr. COLE. We have controls because at one point where we were increasing steadily in the amount of lead usage in gasoline, some 10 years ago nearly, there was no harm at that stage, but at some point, if the growth had continued, you may have reached a point where there might have been harm. And if I recall correctly the position of the industry at that time was: there is no harm, let's hold it where it is.

Senator EVANS. OK.

Thank you, Mr. Chairman.

Senator STAFFORD. Thank you, Senator Evans.

Senator Symms, we are glad you are here. If you have any statement, we would put it in the record at the beginning of the hearing, and if you have questions, please go ahead.

Senator SYMMS. Thank you, Mr. Chairman. I apologize for being late, but I had a conflict with the Trade Subcommittee and the Finance Committee.

I want to go back to the point about rural children. If I understood you correctly, Dr. Houk, you said that group has the lowest lead-blood levels. The EPA, in their cost-benefit study about misfueling, seems like that misses the mark. Out in the country where many farms have old equipment using regular gasoline. Why would it be bad to allow them to continue to use regular gasoline in old trucks and old equipment if, in fact, that is where the children have the lowest blood-lead levels?

Dr. HOUK. In this situation, the blood levels are also not contributed to very greatly by lead in automobile emissions. Where automobile traffic densities are 25,000–30,000 cars per day, it is not at all uncommon in this country to see dust levels at around 10,000 parts per million very close to those roadways.

But in the agricultural community, two things happen, I believe, with leaded gasoline. One, as part of agriculture there is generally the plowing, and the disking, and the turning over of sod, and that keeps bringing the surface-level lead into the lower levels of the soil. Not too many children play out in a field; not great numbers of children will play out into a field. And high levels of lead do not accumulate into that dust.

Also, the agricultural areas have not been subject to the same intense contamination over the past 60 years, with lead in automobile emissions and other sources of lead. Lead in paint generally is not found in the soils and in the dust in rural agricultural areas. There was significantly less lead used in paint than there was in the major cities.

There are good reasons for this, and quite frankly, the lead contamination in the rural areas would suggest to me, where the mean is about 6 micrograms per deciliter, that the child is absorbing about the same amount that the child can excrete through his or her kidneys. It's only when you begin absorbing more than you can get rid of in a day, and over a long-term basis, that you begin to develop toxicity and elevated blood-lead levels.

Senator SYMMS. Do you want to comment on that, Dr. Cole?

Dr. COLE. No, sir.

Senator EVANS. If the Senator would yield for just one question.

Senator SYMMS. Sure.

Senator EVANS. It brings up something that we haven't talked about when you mention the plowing and the turning over of lead in the soil. Is lead absorbed through plants and transmitted then by eating, to the human body?

Dr. HOUK. On leafy vegetables, where one eats leafy vegetables—lettuce, turnip greens; since I am a new Southerner, I have to mention that—a few things like that, it's very difficult to get the lead off that soil. Very little lead is accumulated into the root crops. Very little lead is accumulated into the kernels of grain, though there will be a fair amount of lead on the chaff.

But lead in food is mainly gotten in the following ways: eating leafy vegetables and eating the skins of unclean or unwashed vegetables such as tomatoes. In very high concentrations, it is concentrated and accumulated in the milk. And it also can be concentrated and accumulated in the meat products.

The other, and the most substantial addition to the food process, is in the processing of food, particularly lead used in soldering our food cans. The food industry has taken very responsible action over the last several years to remove as much of that as they possibly can now that they are able to make extruded cans, et cetera. There are very few of those soldered cans left in this country of food that is processed in the United States.

Senator SYMMS. Well, Mr. Cole, I suppose this question would be better to be asked—you may be able to answer it—it might be better to be asked of Joe Cannon. I am sorry I missed his testimony. The chairman might not mind if you chose to answer it.

But I am wondering about how many small refineries—maybe you have the information; maybe Mr. Cannon has it—would be put out of business or be put in a severe financial strain if we have a rapid phaseout. The reason I ask that question is in terms of what the employment picture would be in the lead industry. If we look at this from a macroeconomic sense and want to ban lead in gasoline, there has to be a cost to somebody out here in the economy that has been relying on a livelihood from producing leaded gasoline. So what is that impact going to be?

Dr. COLE. Well, Senator, that's not my area of expertise. I am sure you are right in a general sense. And I would hope that later on in the day, if we hear from refiners and——

Senator STAFFORD. The Chair would be glad to have Mr. Cannon answer that if he wishes to.

Mr. CANNON. We don't have an exact number of the refineries, to our knowledge, that will be affected. The—we expect our rule, however, to have an equal effect across the refining industry—not an equal effect, but to apply the same to large refineries as well as small refineries.

We recognize the last time around, in 1982, when we went through this lead phasedown regulation, at that time we heard a great deal of evidence and information from the small refining industry, and we recognized that there would be possibly severe, localized impacts in that industry.

In the face of that, though, we still felt it was important to go ahead with our regulation then.

Senator SYMMS. If I could ask one more question, Mr. Chairman, and then I know you want to get on with this.

Senator Evans, I thought, brought up a very good question about using leaded gasoline, for the first 60 years and we didn't necessarily have adverse effects in the general population as a result of it, do you have an opinion on that? If it caused such adverse health effects, then why hasn't it appeared in the general population, why has it been inner city youth or people who worked in the industry? Why hasn't it been in the general sense across the country?

Mr. CANNON. The other panelists are much better able to answer that. I can give you really more or less a layman's perspective. Most of the regulations we develop at the agency have benefits that are hard to discern in the general population. If you look across the whole population of a couple hundred million people, you can't see the effects, the epidemiological effects, on individuals. It's very rare—it's very difficult to isolate these effects. That's true with respect to most of our regulations.

With respect to lead, however, we know of numbers of incidents. We can estimate the numbers of children affected by higher blood-lead levels that are in the thousands and thousands. So it's—while I can't point to evidence on my block, which I happen to live in a suburban area, I can't point to evidence on my block. Yet we know that there are thousands of children across the United States which would be—you can't readily and quickly identify, but in fact exist with high levels of lead in their blood. They come into clinics all the time; they're studied all the time.

So I don't know if I can give a more precise answer. It's true, though, in general, when you're dealing with large populations and small effects of pollutants, it's not always immediately obvious.

Dr. HOUK. Dr. Needleman's work was not in inner city black children, it was in white middle-class suburban areas of Boston. He can describe that.

Dr. Ernhardt's original work was in middle-class black section of New York, of a relatively affluent section of Queens, before she recanted, for some unknown reason, her data and said that she had analyzed it incorrectly sometime after she moved.

We are measuring the effect of lead in children. The high-dose source, the DEF that is generally associated with lead paint, did come from the inner part of the cities of the Northeast where lead paint was very heavily used.

I would agree completely with Dr. Cole on his comment about that we should not discuss the issue of hypertension because that has not been thoroughly and completely analyzed yet. That's a potential, and we are looking at it, and it will be looked at.

But lead has gone from the pattern of the black inner-city, poor kid of concern to the relatively affluent white kid of concern, and it also is one of the major health hazards of people moving back into our cities.

Senator SYMMS. Dr. Cole, I think you wanted to make a comment here.

Dr. COLE. Yes, Senator; this business about showing that there are lower numbers of children with—or showing that lead in gasoline is somehow related with children with blood leads above 30, as suggested by Mr. Cannon, is really dependent upon an acceptance of the extrapolation of the NHANES II data. And as I mentioned briefly in my statement, there was a study done by the U.S. Gov-

ernment, EPA was involved, and Dr. Houk was involved, in which they indicated that in a heavy traffic area, in Dallas, TX, the contribution of traffic to blood lead was one microgram per deciliter.

Now, if the average blood lead level is around 12, that's less than 10 percent. Certainly, that kind of a contribution is not going to cause very many blood leads above 30. Clearly, that is the case.

Also, along that same line, Dr. Chisolm and Dr. Bornschein have done work in cities and have seen over the last 5 years that even somewhat marginally elevated blood-lead levels have not declined, even though lead in gasoline has gone down.

And the reason for that, quite simply, is that old lead paint is still a problem. It's not just a problem with blood leads in the 60, 70, and 80 range, it's also a problem in the 30, 40, and 50 range.

Senator SYMMS. Thank you very much.

Mr. Chairman, thank you very much.

I might just say, Mr. Chairman, that I did a little experiment of my own this week, and I have observed in the U.S. Senate that when we have all-night sessions, that the lead levels in the seat of the pants of the Senators accumulates as the week wears on.

Senator STAFFORD. Well, since the Senator has made that observation, it reminds me that the age group from 15 to 21 must have a severe lead problem also, because I remember being told often by coaches to get that lead out.

I think we have finished, and gentlemen, we are very grateful to you for coming and counseling with us.

We will ask the next panel to please come to the witness table. And we would ask our guests who are leaving to do so as quietly as possible.

The next panel will be Dr. Howard Mielke, the Lead Coalition, Minneapolis, MN; and Mr. Eric Goldstein, staff attorney, Natural Resources Defense Council, Inc., of New York.

I would ask our guests who are leaving to please do so quietly, as we have a long hearing still ahead of us.

We are going to ask this panel and those that succeed it—and there are two more—to summarize their statements in 5 minutes. And we will be watching the clock. We regret the necessity for doing that, but that is required by circumstances. All of your statements will be in the record in full. If there are questions from members of the committee who cannot be here, or from those who are which can be submitted in writing, we would reserve the right to all members to do that.

Having said that, Dr. Mielke, you're at bat.

STATEMENT OF DR. HOWARD W. MIELKE, DEPARTMENT OF GEOGRAPHY, MACALESTER COLLEGE, AND MEMBER OF THE LEAD COALITION OF MINNESOTA

Dr. MIELKE. Thank you very much, Mr. Chairman. I am Howard Mielke. I am a teacher, a researcher, a parent, an urban citizen. I represent the Lead Coalition. I appreciate the opportunity to appear before this committee to discuss our understanding of the seriousness of the lead problem.

The Lead Coalition is an organization that represents a number of civic and environmental groups and individual citizens in Min-

nesota. The group formed when it became clear that the need for a low-lead environment for our children was not being met. We are parents and adults who speak for the children in our society who cannot speak for themselves.

I will summarize my statement by making three points concerning lead in the city, urban lead and children, and the urgency for acting immediately to ban the major aerosol source of lead: leaded gasoline.

My first point is that the current combination of public highways and the use of leaded gasoline causes an accumulation of lead in the heart of our major cities. I have with me some soil samples from play areas in Minneapolis in an inner-city community called Cedar Riverside. But these soils could be from Manchester, VT; Boise, ID; Seattle, WA; Dallas, TX; or Fargo, ND—every major city in the United States.

The samples came from a densely populated area, an urban community that has very high traffic flows through it. And in the appendix to my statement I compare these samples from Cedar Riverside with some samples that were collected around a community with a lead-producing plant, also in Minneapolis.

The State of Minnesota cited the lead plant because it was contributing too high an air emission to the environment. Yet when you look at the ambient environmental lead levels, you find that the inner city has twice the levels as were found in the neighborhood of the lead plant.

Why has this happened? In Minnesota we have around 10,000 pounds of lead aerosols from secondary smelters and producers per year which is being controlled by the State.

By comparison, motor vehicles emit 2 million pounds of lead aerosols in Minnesota per year. These aerosols are subject to Federal laws and the State and municipalities are prohibited from doing anything about them.

Minneapolis receives about 300,000 pounds of lead aerosols per year from vehicle exhaust. The amount of lead aerosols in Minnesota—and in fact, 28 other States—increased in 1983 as a result of changes in Federal standards. The increase in Minnesota was 15 to 20 percent.

So who is being protected by the present law and the present standards? In Minnesota, we can do something about lead aerosols emitted from secondary smelters, which are very small, but we can't do anything about the enormous emissions from the major source, lead aerosols from gasoline.

My second point concerns 300,000 pounds of lead aerosol dust per year affect the people of the city.

Senator STAFFORD. You have about 1 minute remaining.

Mr. MIELKE. Not all people are equally sensitive. Children are the major victims. And it turns out that very small amounts tenths of grams—of this soil from play areas of Minneapolis can potentially create serious health problems to children who regularly play in these soils and suck their thumbs.

All children are vulnerable to exposure, and one of the situations we find, for example, is that children love parades. On June 2, my family and I went to a parade along Grand Avenue, which is a very heavily traveled avenue. The children sit on the curbside, and

watch the floats go by. Candy and bubblegum one thrown from the floats. And thus we find children with very sticky fingers sitting on the curb with their hands constantly going back and forth, between their mouths and the ground. The soil lead levels of Grand Avenue are on the order of 500 to 1,000 parts per million.

So what we start out with as fun and frolic, ends up being a tragic situation where children are being exposed to lead aerosols that have accumulated in the city.

My third point is that because children are most sensitive to lead during the first years of life, waiting 4 more years to ban leaded gasoline will expose another generation of children to execessive lead levels. Since the learning ability of thousands of children and future citizens are being decreased by lead, there is some urgency to acting sooner.

Senator STAFFORD. Could you summarize quickly?

Mr. MIELKE. Yes. In summary, I want to say that the city has a serious design flaw that causes lead to accumulate in it; that the major source of new lead aerosols are leaded gasoline; that Federal law prohibits States and cities from controlling these lead sources; that children, urban children are at the greatest risk; that as a result of the excessive exposure to lead, children are being robbed of a major resource, their health and their mental abilities; that there seems to be no engineering or economic justification to keep lead in gasoline.

The needs of the children of our society should take precedence in order to have a bright future. And with that, I would close my statement.

Senator STAFFORD. Thank you. Thank you very much, Dr. Mielke.

Eric.

STATEMENT OF ERIC A. GOLDSTEIN, STAFF ATTORNEY, NATURAL RESOURCES DEFENSE COUNCIL, INC.

Mr. ERIC A. GOLDSTEIN. Thank you. My name is Eric A. Goldstein, and I am a staff attorney with the Natural Resources Defense Council in New York.

NRDC has long been involved in public health issues, including airborne lead pollution and we brought the original suit to compel EPA to regulate lead in gasoline in 1972. We have closely followed EPA's Lead-in-Gasoline Phase-Down Program since then.

Before summarizing my prepared remarks, I want to respond briefly to a comment made by a member of the previous panel.

We believe a real injustice has been done to a dedicated scientist who has no pecuniary interest in the outcome of this debate. I am referring to Dr. Herbert Needleman, who is the model of public-spirited, public-minded medical expert and who has graciously appeared here today on his own time and at his own expense. Comments made by a representative of the lead industry in the previous panel unfairly criticizes Dr. Needleman by citing to a draft document that was never approved or published in final form. A reanalysis of Dr. Needleman's work, done in response to the committee that prepared that draft, essentially duplicated Dr. Needleman's earlier findings. And EPA in its carefully prepared cost-ben-

efit analysis, cited six other studies which also reveal similar, although not precisely the same, learning disabilities and IQ deficits. EPA determined that even if it were not to rely on the study by Dr. Needleman, available evidence on the low-level lead impacts would allow the Agency to reach the same conclusion on the need for further controls.

And I might add that in 5 years of my own legal and administrative work on this issue, I have yet to meet a single scientist or physician not connected in some way or another with the lead industry who could stand here today and seriously deny the existence of adverse impacts from low-level lead exposures and the important role that gasoline emissions play in causing or exascerbating those problems.

With that, let me quickly summarize my prepared remarks.

NRDC supports the thrust of Senate bill S. 2609 and applauds you, Senator Durenberger, for your initiative in placing this issue before the committee. Establishing a mandatory timetable to eliminate lead in gasoline is appropriate in view of the delays that have characterized lead phasedown over the years, and the possibility that future administrations will not share the concern that Mr. Ruckleshaus has expressed for getting the lead out.

We believe, however, that, in view of the serious public health and environmental problems posed by lead in gasoline and the lengthy period that industry has had to prepare for the switch to unleaded fuel, S. 2609 should be amended to provide for a phaseout of lead in gasoline by 1986, with a continuing provision, of course, for some light leaded fuel of 0.01 grams per leaded gallon to deal with the small percentage of vehicles that may need lead as a valve lubricant.

Waiting 4 more years until 1988 before mandating action by EPA is, in our view, simply too long a delay. Meanwhile, as Congress moves forward, EPA should act promptly by publishing its long-awaited proposal to eliminate lead in gasoline. The existing situation in which the agency has announced its likely actions in the press but not in the Federal Register has caused confusion for all affected parties. The time for formal EPA action has arrived, and we are pleased to hear today from Assistant Administrator Cannon that we can expect that action promptly.

You have already heard about the public health impacts of lead, about the threats from leaded gasoline of ethylene di-bromide and ethylene di-chloride emissions and about the impacts of fuel switching.

It was these concerns that prompted NRDC along with Massachusetts, Illinois, New York, Chicago, nationally prominent physicians, and other public health and citizen organizations to petition EPA to phase out lead in gasoline. That petition was filed last March.

The Senate bill would attack these problems by mandating that by January 1, 1988, the addition of lead to gasoline would be unlawful for general use. But we believe that waiting until 1988 is too long. Why? Because the costs delaying action beyond 1985 are staggering.

Although the Agency's detailed cost-benefit analysis focuses on 1988, we can use that report to approximate the real costs of delay-

ing action beyond 1985. In both 1986 and 1987, we can estimate that retaining the existing lead lead-in-gas standard would mean an additional 43,000 children each year could exceed the Centers for Disease Control's safety threshold of undue lead exposure.

Additionally, the cost to consumers in those 2 years could exceed $780 million from added maintenance expenses and quantifiable environmental health costs that could be avoided if the low-level lead alternative were implemented earlier.

If this Nation cannot act swiftly to rid our environment of toxic lead gasoline it will be hard to imagine another issue where we could find so compelling a public health and environmental rationale for action.

Finally, I might add one thing.

Senator STAFFORD. Quickly.

Mr. ERIC A. GOLDSTEIN. Yes, of course. We can expect that some segments of the industry will assert that the date of 1986 is too soon and that more time is needed. This is an unsubstantiated claim. Some gasoline marketers have already indicated that they could meet a 0.01 grams for leaded standard by January 1, 1986, and I reference their comments in my prepared remarks.

There are several ways in which the lead industry could rapidly meet a final phaseout of leaded gasoline. One is to make full use of existing refinery capacity. Existing refinery capacity is now at only 78 percent.

The second is to accelerate construction of additional refining capacity. The industry has known about this for over a decade. And swift action by EPA would give them 18 months to comply.

And, third, they could increase use of alternative octane enhancers.

Senator STAFFORD. That's fine. Keep going quickly.

Mr. ERIC A. GOLDSTEIN. You will find the remainder of my comments in the record. Thank you for your time.

Senator DURENBERGER [presiding]. Yes; both of your statements in full will be made part of the record.

Eric, before I let you go, I think it was in March of this year that the Natural Resources Defense Council brought suit on behalf of a number of States and cities to ban leaded gas, would you explain why States and cities don't have the legal authority to ban leaded gasoline, if they do not?

Mr. ERIC A. GOLDSTEIN. The Clean Air Act in section 211 deals with the lead-in-gas situation, as you know, and generally it preempts State and local action except in two circumstances.

It says that a locality can implement a tougher lead-in-gasoline standard if the lead-in-gasoline control strategy is included in a State implementation plan and if EPA finds that this strategy is necessary to achieve the national ambient air quality standard.

The second situation is when there's a waiver by the Administrator regarding emission standards under section 209, a provision that is unlikely to be used frequently.

So the overall thrust has been to concentrate on the Federal Government to do this. Although there has recently been increasing action at the local level in an effort to address the lead-in-gas issue—and I believe this will continue to be the case until the Federal Government acts—it may not serve anyone's interest to have a

variety of local initiatives that create differing standards in different jurisdictions.

We believe that the Federal Government is the appropriate party to solve the gasoline-lead problem.

Senator DURENBERGER. Thank you.

And thank you, Dr. Mielke. I appreciate not only your statement but a lot of other publications that you have put out in this area, and I obviously regret that you can't wholeheartedly support my bill but prefer the quicker phaseout.

But after sitting through this hearing this morning, I think you will understand that what I am proposing to do here is being attacked from one side for doing anything at all, from the other side for not doing it fast enough. And one of our problems is that it takes forever to do anything on the Clean Air Act.

So I appreciate your help in bringing some of Minneapolis with you. You can leave a little of it behind if you want.

Mr. MIELKE. You wouldn't want to touch it, by the way.

Senator DURENBERGER. No. OK.

Mr. MIELKE. Don't put it in your mouth.

Senator DURENBERGER. Well, I won't throw candy in parades anymore, either.

Thank you very much, both of you. I appreciate your testimony.

Mr. ERIC A. GOLDSTEIN. Thank you, Senator, for getting this process rolling.

Mr. MIELKE. Thank you.

Senator DURENBERGER. All right, our next panel is Mr. Lawrence Blanchard, Jr., vice president of the Ethyl Corp., Richmond, VA; Mr. Fred Bowditch, vice president, technical affairs division, Motor Vehicle Manufacturers Association in Detroit; Mr. Richard H. Lincoln, director of environmental affairs, Outboard Marine Corp., Waukegan, IL.

I appreciate your patience, gentlemen. It's taken us 2½ hours to get halfway through our program, and I want you to know I have a hearing to attend in the Finance Committee at 2 o'clock. So the rest of this will go fairly quickly. And I will, without objection, have all your prepared statements made a part of the record.

In addition, I have a variety of questions that I would appreciate your responding to. I would love to ask them here in this environment so we can get all sides of this covered, but I am afraid I am going to have to submit them to you in writing, if that's all right, so that your reactions can be made part of the record.

So we will start with Mr. Blanchard.

STATEMENT OF LAWRENCE E. BLANCHARD, JR., VICE CHAIRMAN, ETHYL CORP.

Mr. BLANCHARD. Senator, after sitting through the last 2½ hours, I can't help but feel this is a "This is Your Life," except you've assembled all my enemies instead of my friends. It's a right ominous experience to sit out there and go through this, but I have been doing it now for—appearing before all these committees, including yours, for 14 years. And I have learned in that time, and I have said many times, that if you'll give me somebody with a gen-

erally open mind, give me about 20 minutes, I can put this complicated subject into some focus.

But obviously, doing it in 5 minutes is probably impossible. As a result, it seems to me I——

Senator DURENBERGER. That took 1 minute. You've got 4 left.

Mr. BLANCHARD. The clock's running pretty fast.

As a result, I do just have to rely on my statement. Obviously, I can't do anything in 5 minutes. I am sorry Senator Evans is not here, because I was just fascinated by his simple question, which is so simple, as to why is it difficult to find out what the comparative effects are from lead in the air and lead in paint. Why can't you devise a simple test?

And I reached in my briefcase and found my testimony before the EPA in Los Angeles on May 4, 1972, in which I pointed out that the effects of things other than leaded paint are not as difficult to determine as some people would have you believe.

In the publication, "Lead Poisoning in Children," published by HEW in 1967, it is stated that lead poisoning was simply not found among children in newly constructed housing projects in New York City even when these were in districts which had a high incidence of childhood-lead intoxication.

The report concluded—by HEW—that this indicates that lead poisoning in children is inextricably linked to old, dilapidated housing.

The point is further confirmed by a well-known study in Cleveland, where it is reported that of 801 young children in old housing, 38 children, or 4.7 percent, had lead intoxication, while not 1 child was found to have lead intoxication among 105 children studied who lived in a new housing project.

It seems to me that was completely responsive to Senator Evans' point.

Going over to what I submit still is a complicated subject, in essence, even Mr. Ruckleshaus recognized this in the beginning, that if you take lead out of gasoline, something has got to take its place, and that something is usually aromatics, which has been a source of considerable concern to the EPA from the very beginning.

And it is almost impossible to discuss octane without understanding what the lead pool is. In America today, in the United States, all the total gasoline produced by everybody has a pool octane of roughly 86. You can take that 86 octane and you can slice it up in various ways. You can take the goodies out of it, the highest octane components in that average 86, you can put all the goodies into lead-free gas, and you'd come up to say, 89 octane. That reduces today, with roughly 40 percent of the gasoline being leaded, that reduces the rest of the pool down to 83 because you've taken the goodies out—the goodies meaning the higher octane component—and you've got 83.

Today, at 1.1 gram a gallon, which is permitted in leaded gas, that adds just about 6 octane numbers at a remarkably low cost of about three-quarters of 1 cent to get 5 full octane numbers, and brings the 83, when you add lead just 1.1 gram, that brings it up to 89, which is what the total pool is.

If you don't take lead out, you lose those 6 octanes which spread over the whole pool amount to roughly 2½ to 3 octanes.

So what you're talking about is how you go about replacing 2½ to 3 octanes and what does it cost to do it. And that's what the issue is on the economics.

I know my time is up, and I will just have to try to respond if you have any interest.

Senator DURENBERGER. Thank you. Very well, you're now an honorary northern New Englander.

Mr. Bowditch.

STATEMENT OF FRED BOWDITCH, VICE PRESIDENT, TECHNICAL AFFAIRS DIVISION, MOTOR VEHICLE MANUFACTURERS ASSOCIATION

Dr. BOWDITCH. Senator, we welcome the opportunity to present MVMA's views on lead in gasoline and the phasedown as it relates to the provisions of S. 2609.

Motor-vehicle manufacturers have been leaders in the effort to reduce or eliminate the amount of lead in gasoline since the early seventies, even prior to the introduction of catalytic converters.

Since the introduction of the catalytic converter in 1975, essentially all domestic cars and most light-duty trucks have required the use of unleaded gasoline. The result of this and the decreased lead content in leaded gasoline, the lead used in today's gasoline represents approximately an 80 percent reduction since 1970.

As a consequence of significant increases in the cost of gasoline, combined with a favorable price differential of leaded gasoline compared to unleaded gasoline, and the widespread growth in popularity of self-service gasoline stations, a major misfueling problem has developed with respect to catalyst-equipped vehicles.

EPA estimates that over 13 percent of the vehicles in use today that require unleaded fuel are being misfueled, intentionally or unintentionally, by their owners. No doubt, misfueling can permanently damage catalytic converters emission control systems which have been so effective in achieving dramatic reductions in emissions from mobile sources.

In order to minimize compromising this progress, MVMA is unanimous in its support of efforts to combat misfueling. Certainly, the removal of lead from gasoline available at the retail pump, or restriction of its availability, would help eliminate the problem.

MVMA members are also unanimous in their support of a more aggressive program to phase down the amount of lead in gasoline. In general, MVMA members do not believe that shifting from leaded to unleaded gasoline will cause major operational or engine-life problems for most of the vehicles still in use which were originally designed to operate on leaded fuel.

However, there is not total agreement among our member companies as to whether lead should be completely removed, as is proposed in the bill S. 2609.

The differing views may result from the paucity of data which exists. Engine manufacturers have not conducted extensive engine durability tests with lead-free or low-lead fuel. Therefore, any assessment of the impact of eliminating lead from gasoline becomes one involving engineering judgment as to the satisfactory engine

operation, about which the experts, needless to say, do not all agree.

In commenting on an EPA report that concluded that the lead level of a tenth of a gram per gallon would be wholly satisfactory, General Motors filed with EPA its opinion that there is a significant risk at that level of lead of severe valve seat recession and valve seizure problems, particularly with those engines that are operated at high load and/or high speed for sustained periods of time, which are typical operating modes for many commercial and agricultural applications of heavy-duty gasoline engines.

General Motors has recommended to EPA that a low-lead fuel containing two-tenths of a gram per gallon should continue to be made available at the retail pump to protect heavy-duty gasoline engines which are in production and still in widespread customer use.

However, all of our members believe that if such a lead phasedown is to be adopted, the determination of the amount of lead and the duration of its availability should be left to the discretion of the EPA Administrator, and not be a matter of congressional direction.

In summary, EPA strongly supports the phasedown of the amount of lead contained in gasoline, but believes that the rate of phasedown and the ultimate date of phaseout should be left to the EPA Administrator to determine based upon a thorough review of all relevant factors involved in making this important but technically complex decision.

Thank you.

Senator DURENBERGER. Thank you very much.

Mr. Lincoln.

STATEMENT OF RICHARD H. LINCOLN, MEMBER, BOARD OF DIRECTORS, NATIONAL MARINE MANUFACTURERS ASSOCIATION, AND DIRECTOR OF ENVIRONMENTAL AFFAIRS, OUTBOARD MARINE CORP.

Mr. LINCOLN. Senator, thank you. I am Dick Lincoln of Outboard Marine Corp. I am appearing today as an officer and member of the board of directors of the National Marine Manufacturers Association, which is the national trade association of the recreational boating industry. On behalf of the 800 member companies, we do thank the committee for allowing us to testify.

Our industry is keenly aware of the national health concerns that S. 2609 seeks to address. We are not opposed to a reasonable phasedown of lead in gasoline, but we think that on balance S. 2609 attempts to preempt EPA's responsibility under the Clean Air Act, and in doing so, it may cause more problems than it solves.

For example, the proposed ban on lead for highway motor vehicle use we believe will, in reality, constitute a total ban on the production of any leaded gasoline. That's because of economic feasibility. And we believe that the leaded fuel will disappear from the market very quickly.

Now, because recreational marine use is less than 1 percent of all gasoline used, and because no separate distribution system exists for marine fuel, there will be no leaded fuel for boats. And

another point, 85 percent of marine fuel now is bought at regular corner filling stations.

A large segment of marine engines out there now depend on leaded fuel to provide adequate performance and to retard catastrophic engine failures. Those engines were designed to run on leaded fuel. And generally speaking, it still is a fact that the higher horsepower engines are designed, and demand, high-octane fuels, and the banning of tetraethyl lead, which is the best and least costly octane enhancer that we know of, will force a proliferation of alcohols, aromatics, and other additives to regain octane performance. I am coming back to that.

Lead serves one other function for us in the marine industry. It is an excellent lubricant in the two-stroke cycle powered outboard motors. It provides lubrication and helps prevent failure of pistons, piston rings, and bearings. In the four-stroke engines that are used in marine, it is also the preventative for exhaust valve recession, and no other gasoline additive has comparable qualities.

This bill would force the petroleum industry to switch to different fuel additives in order to achieve octane. And many of those alternatives could spell real trouble for the marine industry. The oxygenates—the methanols and ethanols—which are used as octane enhancers are virtual solvents of flexible fuel lines and other fuel system parts which are used and have been used for 30 years throughout the industry.

Methyl additives, in particular, add another problem. They actually are so corrosive that metal tanks and other metal parts will be corroded by them. And it's a dilemma with us that flexible, nonmetallic lines which I have just described, fuel lines, are required by Coast Guard regulations on all inboard powered vessels in order to prevent vibration fatigue. Those flexible lines are also used on all outboard designs. And the result of this is that the alcohols can permeate and deteriorate plastics and elastomers and corrode metal parts of fuel systems in boats and it can cause fuel leaks into the engine compartments and bilges, causing a severe risk of fire and explosion. And that corrosion condition would be accelerated because the marine atmosphere contains a lot of moisture, and that's a bad thing.

The boating industry has long been committed to boating safety, and we are very proud of our record over the years of having improved boating safety, and we don't want to see that destroyed.

There are 10 million recreational boats in the field now in use, and virtually all of them contain some of the components which would be attacked and possibly destroyed by these alcohol-blended fuels, and that would subject a very large segment of the American public to extraordinary risks.

Another aside, even if old engines happen to wear out and are replaced, that would not even guarantee that the tanks and lines which are built into the boats would necessarily be replaced at that time, and we submit that this committee should carefully consider the public safety risks to America's 60 million boaters that may result in a ban of lead in gasoline.

And we recommend, and we state, that the marine industry is prepared to work with EPA toward an overall phasedown of lead concentrations. And we suggest as a starting place a goal of 0.5

grams per gallon, and we feel that we could achieve that by 1990. And that would represent more than a 50-percent reduction of the present 1.1 gram per gallon.

And the National Marine Manufacturers Association pledges its cooperation with EPA to establish those target levels and timetables, and we ask for this committee's support by not reporting S. 2609.

Senator DURENBERGER. Thank you very much.

I certainly empathize with your statement, Mr. Lincoln, but I haven't heard any testimony here today, and I don't expect to hear any the rest of the day, that doesn't tell me that you aren't in trouble anyway. Whether through passage of this bill or with Joe Cannon's notion that they're going to accomplish the same thing this bill does by regulation, it's coming.

If you buy the theory that we pass a Clean Air Act amendment that penalizes people for misfueling or in some other way get at what's happening to catalytic converters in this country, the marketplace is coming anyway, and it's going to make it much more difficult for me to go into town—I've got a couple or three outboards—it'll make it much more difficult for me to go into town to the gas station where I always go.

So, while I can empathize with all of your concerns, I have got a big question mark here that says I can't believe that the marine manufacturers aren't in some way already dealing either with the other end of the table there, the Ethyl Corp. or with somebody else who's in the business of providing change in octane, change in lubrication, or whatever—and I hope you are, because the only question we're dealing with here today I think is when and how this process of, in effect, banning much of lead in gasoline arrives on the scene.

Mr. LINCOLN. Certainly—if I may address that question—we certainly are working on these problems, and we expect solutions. We have made significant progress in that, as Senator Stafford pointed out, many of the engines which we produce now recommend the use of unleaded fuel.

Some of them do not, and it's the high-output, high-RPM, high-loaded engines which still demand the lead because of octane and lubrication. And it does take time. We've been working on it for 15 years, and it's a long, slow development process.

Senator DURENBERGER. Dr. Bowditch, let me have you deal a little bit with the octane business. Maybe you can talk to us a little bit about the alternative additives that might be used for lubricants and then talk to us a little bit about the whole octane-enhancing problem. And let me just ask you to comment. I had breakfast this morning, not in connection with this, but with a gentleman from Germany who is the European Economic Community's minister in the area of chemicals, the same thing we do here in TOSCA. And somebody mentioned lead, and we got onto the subject of octane and automobile manufacturers in Europe.

He indicated that the octane levels in gasoline produced for the kinds of engines in automobiles used in Western Europe are anywhere from 94 to 98 octane. Now, that conflicts with what I have heard here about a U.S. average of 86 and what I see on my pumps and so forth.

And as you probably recall, one of my amendments to the Clean Air Act dealt with studying the relationship between what the refiners can do and what the motor vehicle manufacturers can do. And maybe you could briefly deal with this issue for us.

Dr. BOWDITCH. Well, let me say, initially, that I think we're talking different kinds of octane numbers. You were talking one kind of octane number with your German industry associate this morning. And I believe Mr. Blanchard is speaking about a different octane number, the number you see on the gasoline pump. What your German associate was talking about is just the R, or the research number, which is 6 to 10 numbers higher than the M or motor number. There are two ways of rating octane quality, and that's the reason for much of the confusion. Mr. Blanchard was speaking of the average of the two numbers or R plus M over 2.

Also, you must recognize that the European gasoline situation is significantly different than it is in this country, in that the German industry uses only about 20 percent of a barrel of crude to make their gasoline. So they have the other 80 percent that they'll use for things like diesel, or power generation, and the rest of it. In this country we use about 50 percent of every barrel of crude that we see in this country into gasoline, and it's only the other half then that goes into things such as diesel fuel and so on.

So the refining industry does face different kinds of problems domestically here in the States and in a country like Germany.

In terms of the initial questions that you asked, the lubrication problem, we think we've pretty much handled those problems as a result of changes in designs of our engines. We can pretty much design around this lack of lubrication by going to the hardened seats and the different kinds of materials in valves, and guides, and the rest of it. And this is essentially what we've done, of course, with the passenger cars that are going to have catalysts on them. We have to make those for certain such that they don't need that kind of lubrication.

Our industry has done essentially the same thing for heavy-duty gasoline engines as well. We've gone essentially the same route; even though there hasn't been the catalyst converter and therefore the absolute need for it, we've tried to introduce into those designs everything that should handle much of the lubrication problem.

Now, there is some disagreement, as I stated in my statement. General Motors still feels that they would like a little bit of lead in there, not very much, but just a little, to make sure that sufficient lubrication is going to be there, even with the hardened seats and all.

Our other members, Ford and Chrysler, for instance, don't believe that's necessary. And it's mainly a judgment call.

Senator DURENBERGER. On the octane issue, then, is there no need to raise the octane rating?

Dr. BOWDITCH. Our members do not show a concern with the existing truck population that's out there. They feel that to some degree, obviously, the refiner is going to be increasing his octane quality. That's what competition is all about. A little bit by the refining end and a little bit by the addition of alcohol, which Mr. Lincoln was talking about.

We, too, have concerns about excessive amounts of alcohol. I think that he would agree with me that in appropriate quantity we can accommodate either ethanol or methanol, the two alcohols that are used today. And if used in judicious quantities, you can still get two or three research number increase in octane quality, not as much as we lost by taking the 1.1 gram out, but at least we're halfway back to where we got started from.

On balance, our manufacturers believe there will be adequate octane quality to handle the problems of the existing truck fleet that's out there as well as future trucks, which of course we can design around once we know exactly what we're dealing with.

So that's our situation.

Mr. BLANCHARD. Senator, may I add one thing to your point about your German friend that gets at what Fred was saying? I deliberately went to what is called R plus M over 2, which is not the way most of us traditionally grew up thinking. We thought in terms of research octane number. We used to have 100 octane in World War II, 100 octane it took to run a plane. That so-called research octane number, there's something called a motor octane number that's lower. And the industry now has gone to something called adding the two together and dividing them by two and come up with an average, and that's R plus M over 2. That's the system that we now use in this country on the pump and which is my 86 I referred to.

The difference between R plus M over 2 and research is roughly four numbers. So I-86 would be 90 research. And in Europe they are at like 94 to 96, because they have always believed in high octane because of the efficiency of the high-compression engine, and they believe in using more lead so they can get efficiency and get high octane, which because of the high price of their gasoline that enables them to get more efficiency in the car. And that's why they've always had over there a higher octane. That's just to put the numbers in perspective.

Senator DURENBERGER. I appreciate that very much.

And I have to let the panel go and ask you questions in writing, but, Mr. Blanchard, I know your company invented leaded gas long before you got there, but did you also invent EDB as a gasoline additive? And if so, can you explore with us what you know about potential health effects of utilizing EDB?

Mr. BLANCHARD. The potential what?

Senator DURENBERGER. Ethylene dibromide.

Mr. BLANCHARD. Yes, but I missed your words there, something about the——

Senator DURENBERGER. Health effects.

Mr. BLANCHARD. Oh, health effects.

Senator DURENBERGER. Are you looking at it as a company in terms of the health effects of the utilization of EDB?

Mr. BLANCHARD. Well, we agree with—one of the few places we agree with Mr. Cannon, I guess—is even the EPA recognizes that the amount of EDB that is left after the combustion process, the part that's put in gasoline that's left after the combustion process, is in his words, "so insignificant as to be infinitesimal and is not a problem." And even they don't think EDB is a problem in gasoline.

Senator DURENBERGER. And how about at the pump, for people who operate the pumps?

Mr. BLANCHARD. That has been studied—a great many studies on that, that the amount in the atmosphere is so tiny in relation to, say, gasoline vapors themselves—I mean, after all, unleaded gasoline it self is a carcinogen, well know, and the vapors from that, if you think that's a problem, there's no significant difference in the amount that's in an EDB.

The truth of the matter is, I think most people agree, that either one of them is in such tiny quantities in the atmosphere, there's probably not a cause for concern, but I know the EPA is right now looking into the lead-free gasoline problem.

Senator DURENBERGER. My last question of you—and I know you're not here to speak for an industry, but Dr. Cole has to a degree at least confused me about what the "industry position" might be. I understood it to be as simple as believing that EPA would get the job done more appropriately if they don't have legislation requiring them to do it. But I get the impression from the response that Dr. Cole made to Senator Evans' question that at least a portion of the industry believes that no more change in the current situation is necessary, that lead in gasoline is not a health problem in the United States of America, all we got to do is make sure it doesn't get too far out of hand, but if we just let it there at some appropriate level, it's no problem.

Is that your position?

Mr. BLANCHARD. Well, unfortunately, I don't know that it makes much difference what I think, because obviously the EPA doesn't pay much attention to me.

In the sense that we most sincerely feel that the step they took in 1982, which was after probably the most debated, most debate they've ever had on this subject, and they concluded to go to 1.1 per grams—per gallon of leaded gas, with the idea, with the avowed purpose that as leaded gas came down, the amount of lead in the atmosphere would never go higher than it was then and it would continue to fade right on out. And in fact, it's now down to having been reduced 80 percent, and I can certainly speak for our business, it is going straight on down the tube. I, my employees, and everybody else, it's going right on out. If you don't do anything, it's going right on out, very rapidly as these old cars, which have stuck around a long time because an awful lot of people have hated to give up that old car, but the problem is that that old car just can't last forever. And all of them now are between 10 and—the youngest one is 10 years old, and they're just going to be gone.

And therefore, you're going to get a phaseout if you do nothing, I mean a very dramatic phaseout. But if you do it by that method, you do not create a problem for the cars on the road now, you do not create a problem with the valve seat problem, and you phase it out rapidly. But the way the EPA originally wanted it done so you didn't create these problems of increased aromatics, increased refiner problems, of putting substitutes in, and you still are dramatically phasing it straight on out.

Senator DURENBERGER. Let me ask the question differently: what's the problem with S. 2609 other than the date?

Mr. BLANCHARD. I suppose there is—in the sense that the date is just a matter of conjecture, in my case, I think that the phaseout will probably—there will be some little bit left to be sold later than 1988. But even I have to confess I don't think it's going to be very much beyond 1988. The only difference is you're still going to have a few people, God bless them, who've got an old, old car, and they don't want to pay 10 to 15 cents a gallon.

Senator DURENBERGER. And S. 2609 provides a process to take care of that. So what's wrong?

Mr. BLANCHARD. Yes, but I don't see how in the world the EPA can have a special case for the man with the old car. That would mean having to have it at the pump for everybody that's got a car more than 12 years old or some such thing.

Senator DURENBERGER. They're going to have to draw the distinction regardless.

Mr. BLANCHARD. Well, not if you take my approach, which I am saying they probably won't, but that is, do what they wanted to do in 1982, which is just let it phase on out as the old cars go off. That'll end up roughly the same as your approach. There is going to be so little left in 1988 that the idea of this being a health problem with the amount in the atmosphere is just absurd. There's just not that much that can possibly be around after 1988.

Senator DURENBERGER. I have a hard time, Mr. Blanchard, understanding why the folks outside of your business and on and on and on. They come to that same conclusion without some certainty. They are in a multibillion-dollar industry trying to market products with or without Made in America labels, and for them to rely on the statement you just made that we're going to get rid of most lead by 1988 is certainly asking a whole lot of people——

Mr. BLANCHARD. Well, I am sorry, I must not be making my point clear. What I am talking about is not something conjectural. We are permitted to put 1.1—the industry, the oil industry is permitted to put—1.1 grams in every gallon of leaded gas. Leaded gas today, except for the misfueling problem, leaded gas today can only be used basically in the cars built before 1975.

As a result, it is not—it is going to phase out because the cars simply are not going to be around that are permitted to use lead in gasoline. They're just not there.

Senator DURENBERGER. All right, we'll go around on this with you.

Mr. LINCOLN. One major point that ties with that. However, it sort of contradicts what Mr. Blanchard said. But in the case of the recreational boats that are already out there, that are of deep concern from the safety standpoint, I would advise that the average life of an outboard motor and a stern-drive powered boat out in the real world is somewhere between 10 and 12 years.

Senator DURENBERGER. Mine are all older than 12 years old.

Mr. LINCOLN. Well, that means exactly there are just as many of them out there that are older than that, as there are that are newer than that. So ours are not going to disappear quite as quickly. We haven't started our phasedown period yet.

Mr. BLANCHARD. Well, the kind of lead that'll be used to take care of those is just such a trifle that his only question is whether

there are going to be any manufacturers around that it would be worth making it in that quantity. It'll be such a tiny amount.

Senator DURENBERGER. Well, exactly. That's why I raised the question.

Mr. BLANCHARD. Right.

Senator DURENBERGER. Does anybody here prefer an alternative to banning lead that just raises the taxes on leaded gasoline or, as Senator Evans said earlier, requires that leaded gas be sold for at least the same price or a higher price than unleaded? Does anybody like that approach to the problem?

Dr. BOWDITCH. We have no opinion.

Mr. LINCOLN. I have an opinion. I have never in my life to my knowledge recommended or condoned a tax increase of any kind. I say, "No."

Mr. BLANCHARD. And certainly one that is imposed only on people that own an old car.

Senator DURENBERGER. OK.

Mr. LINCOLN. Or an old outboard.

Senator DURENBERGER. All right. Thank you, gentlemen, very much. We appreciate your coming.

Mr. LINCOLN. Thank you, Senator. We welcome your questions. Please write to us.

Senator DURENBERGER. Yes, questions will be submitted.

Our next witness is the Honorable Birch Bayh, former Senator from Indiana. Birch, welcome.

STATEMENT OF HON. BIRCH BAYH, ATTORNEY-AT-LAW, AND FORMER U.S. SENATOR

Senator BAYH. Mr. Chairman, I appreciate the hospitality of your staff, who permitted me to occupy the seat that I occupied about 135 years ago back in that executive room, so that I could meditate and make a phone call or two.

I see the pictures on the wall are much more distinguished than the ones that were of the committee when I was a member. So I want to salute you for improving the quality of the decor of the room.

Senator DURENBERGER. Thank you.

Senator BAYH. I want to apologize. Somewhere between here and the back of my car, which we're now trying to find, are the copies that I promised you. And I hope they will arrive before we're through.

In the meantime, as much as I disdain reading from a prepared text, perhaps I should do so because I still fear I have the senatorial temptation—and I don't mean to be derogatory—but the temptation that I have found as a Senator to take a 10-minute statement and summarize it in 20 minutes. So let me just get to it and say that it's a privilege to have a chance to come before the committee today to express my views concerning the proposed legislation for which you have provided the leadership to ban the sale of leaded gasoline.

I am relatively familiar with the public policy issues raised by this important legislation as a result of my past exposure to them as a Senator and as chairman of the National Alcohol Fuels Com-

mission. But I am here today simply in my capacity as a private citizen who is seriously concerned about the adverse effects of lead use in gasoline on human health, and as a practicing attorney who has maintained an interest in how this particular industry is functioning throughout the United States.

I am well aware that this committee has heard from many witnesses today. I have looked at that list, and certainly you have provided a wealth of information for the committee and those who care to read the record. And they can speak, I am certain, more effectively and with greater expertise as far as the specific health hazards of lead than I, and also the unacceptable consequences of allowing its continued use in motor fuel. Ninety percent of the lead usage in the United States, I understand, comes from that particular source.

So, in my opinion, the overriding need for this legislation from a health perspective should ensure its speedy enactment. However, I am also painfully aware that there are potential roadblocks. There are those who oppose passage of the lead ban primarily because of the requirements that will be imposed if the legislation is enforced in a timely manner in the next year or two.

The major concern expressed is based upon the belief that without lead additives, the Nation will be forced to face an octane gap. Consequently, I think perhaps I could make the greatest contribution, if indeed I can make any contribution, to focus my remarks this morning on the significant potential that I see for the Congress to tap the excellent octane-enhancing qualitites of domestically produced fuel ethanol as a means of meeting this octane gap and thereby meeting a myriad of other important public policy objectives in the process.

While I would be the first to recognize that the use of fuel ethanol as an octane-enhancing agent is not a panacea, I believe that the past 5 years of the industry's development are an eloquent statement of its potential to make significant contributions to the refiners' need for a stable, reasonably priced additive that is environmentally acceptable and has proven performance.

Certainly, Mr. Chairman, you not as the chairman of this committee but as a Senator from the great State of Minnesota and one who is very close to the farm community has been one of those who is personally familiar and has provided leadership in the development and continued expansion of the alcohol fuels industry. So you are personally very well acquainted with this particular fuel and octane enhancer.

To conserve the committee's time, let me look at ethanol's potential as a replacement for lead at the refinery from four general aspects. First, ethanol has developed over the past 5 years from virtual nonexistence to the most significant liquid fuel alternative in the gasoline marketplace.

Second, ethanol has proven capability with automobile engines and proven effectiveness as an octane-enhancing additive at the refinery.

Third, ethanol's production is based upon proven technology which promises optimistic projections of future increased production levels.

And fourth, ethanol—I think we should face directly—ethanol's temporary need for tax preferences and the returns to the taxpayer that result because of the alcohol fuels program.

Now, let me expand on each of these four subjects. Looking at the development of the——

Senator DURENBERGER. We have a limited amount of time, though.

Senator BAYH. Pardon me?

Senator DURENBERGER. Even for former Senators, you have a limited amount of time to expand on that.

Senator BAYH. Well, why don't you hit the gavel when I run out of time, then.

I have not been privy to the time limitations. If you tell me I should stop now, I will and let you read this tonight.

Senator DURENBERGER. Well, it was 5 minutes, and former Senators get a total which doubles it, so you have maybe 4 minutes left.

Senator BAYH. Well, let me just say that, in trying to cover the top of this, I think we have come from a point of total hostility to that of acceptance. I recall being asked last year what had happened to the gasohol program. It was in disarray. There was an article I think in the Wall Street Journal that said gasohol had disappeared, almost disappeared from sales. Well, the fact of the matter is that we have been accepted by the petroleum industry as an alcohol enhancer and they weren't selling gasohol, they were selling ethanol, or gasoline enhancers with ethanol. So we found that we were accepted as a part of the distribution system.

Hopefully, and I think the importance of the discussion here on replacement of lead, is to have ethanol considered as an octane enhancer instead of as a competitor for gasoline. Then the price relationships will not compare the price of producing ethanol from corn with the price of gasoline but will compare the price of ethanol with the price of other octane enhancers. At that juncture I think we will have finally arrived. And I think that will be forthcoming in the near future.

I might just touch on other future. You are familiar with the trade balance implications of ethanol what it means to be able to sell high-protein supplements as an increased income from our exports, and to have to purchase fewer barrels of oil because instead of just dropping a small amount of a chemical into the gallon of gasoline, we're actually replacing 10 percent with locally produced ethanol. That means 10 percent less petroleum that we have to buy. This program actually decreases our trade imbalance and increases the strength of our trade program.

But I would like to talk specifically about what this does outside of the immediate beneficiaries. We know that there is going to be a benefit to American farmers who now are faced to accept billions of dollars of subsidies in this last year. They don't like to do that. They would much rather plant and sell and make a living that way than be on a Federal subsidy. We're familiar with that.

But I think we lose sight of the significant stimulation to the economy generally. Because of the sake of time, I will not go through the whole testimony here, but I will just cite one specific instance of a plant that is being constructed that should start construction probably in September of this year in northern Indiana,

one of the first major products of the legislation which you have supported in the alcohol fuels program.

This plant will produce 55 million gallons of alcohol annually. It will require 20 million bushels of corn, thus enhancing the agriculture in a three-State area there. But also, if you have the privilege of going there, as I did, to see the construction process, there were 800 construction workers, and the estimates are there will be about a thousand, maybe a little more than a thousand, permanent full-time jobs either in the plant or in ancillary industries. Those people will not be on unemployment compensation or welfare; they will be paying taxes. And I think we have to consider that as a significant stimulus to the economy generally.

One last thought, Mr. Chairman, I want to call your attention to the Georgetown study, the CSIS study, which emphasizes the national security aspect of ethanol. Here is a product we can produce in the United States that we don't have to worry about being terminated. We don't have to worry about another embargo if we can significantly increase our alcohol production.

I think we all understand that we are subject to the whims of those people who have our energy supply under their thumb. And to the extent that we can increase our independence, the more capacity we have to fight an embargo, and the less likely it is that an embargo will be attempted.

Mr. Chairman, I will just ask you to put the rest of this in the record and urge you—I don't need to urge you—but urge those colleagues who may not have yet been fully converted to accept the major proposals that I make here; and that is, that we exempt during the interim of full development of this industry, alcohol fuels from the excise tax, gasoline excise tax, in exchange for the States removing their excise tax. That would make a uniform gasoline tax exemption instead of the Balkanized approach which presently exist. I think we have to recognize the need to replace the funds that are taken from the Highway Trust Fund, but since it's a benefit to the whole country, I don't see any reason we can't have a program that recognizes you should not just have one fund, a highway trust fund, support a program that's in the best interests of the whole country.

Senator DURENBERGER. I thank you very much for your statement. And I am informed that a position statement by the Renewable Fuels Association is also going to be made part of the record of this hearing. (See p. 211.)

If it weren't so late and we had a few more members here, it would be a good place to make the argument on the Highway Trust Fund and the argument that you just made in terms of the State exemption versus the Federal exemption. But I won't ask you to explore that other than your statement explores it, but to keep working the Tax Conference Committee and see what we might be able to accomplish with that out of that conference.

Thank you very much for your testimony.

Senator BAYH. Thank you, Mr. Chairman. I certainly appreciate the leadership you provide for this. And I think we're going to be successful, but it's going to take a lot of work. And, of course, if we can do anything to help, let us know.

Senator DURENBERGER. Thank you.

We will now hear from our last panel. We have with us Mr. R. Thomas Van Arsdall, vice president, Agricultural Inputs and Services, National Council of Farmer Cooperatives, Washington, DC; Mr. Martin P. Zanotti, executive vice president and chief operating officer, Saber Energy, Houston, TX; Mr. Michael Redemer, environmental engineer, Beacon Oil, Hanford, CA, and Mr. Robert McCowan, vice chairman, Ashland Oil, Ashland, KY.

We appreciate all of you being here. Your written statements will be made part of the record, and you get to go to lunch early if you summarize your statements in 5 minutes or less.

As I indicated to prior witnesses, I do have a variety of questions for all of you that I will have to submit in writing because of the lateness of the hour.

So we will start first with Tom.

STATEMENT OF R. THOMAS VAN ARSDALL, VICE PRESIDENT, AGRICULTURAL INPUTS AND SERVICES, NATIONAL COUNCIL OF FARMER COOPERATIVES

Mr. VAN ARSDALL. Thank you, Senator.

I would like to touch briefly on an agricultural perspective on the lead phasedown issue. Simply stated in our testimony, a large portion of the power units on farms require leaded fuel. This characteristic will persist well into the future. Right now about 75 percent of our total gasoline sales in the farm cooperative petroleum system are leaded. Over half of the unleaded gasoline that we produce in our refineries is exchanged for leaded gasoline and diesel fuel to meet our market profile demand.

As the farm market retires this leaded gasoline fleet, it is shifting to diesel fuel rather than the trend for the overall economy going to unleaded gasoline.

Perhaps a quote or two from a letter we received from Mr. Wayne Scherer, a farmer in Bandon, OR, can best state the bottom line regarding why the National Council is concerned about this issue. I quote:

> I am becoming alarmed at the possibility of the EPA cutting off the supply of leaded fuel, especially as to its effect on the farm community. I am interested in knowing what the National Council is doing to guarantee the availability of leaded fuel for our farm equipment. Thank you for any information or reassurance that I really have nothing to worry about.

And that was his calmest statement. We haven't replied yet because we're hoping that with time and work we can write him a positive response.

Let me comment briefly on two lead phasedown alternatives that are now most prominently being considered. First, the legislation that you introduced would essentially provide an exemption from lead phaseout for agriculture, while banning the commercial sale of leaded gasoline for on-highway use by January 1, 1988. And the National Council certainly appreciates your good intention in this regard.

Unfortunately, our analysis has shown that the exemption by itself is not likely to make leaded products available in effective fashion for the farmer. There are two reasons I would like to touch upon. First, we're concerned that lead producers would be unlikely to supply a legislatively narrowed agricultural market with their

products at prices that the farmer could afford to pay. And they may not in fact continue to do business as lead suppliers for a market that's only 10 to 20 percent of current size.

Second, we have found that pipelines may be unable or unwilling to ship leaded product in segregated batches in the small quantities demanded by such a curtailed market.

Second, the National Council must strongly oppose the proposal that EPA is currently considering, for reasons that we have stated in their testimony.

We think that there is a viable alternative available that would accomplish the objective of reducing lead use without subjecting the farmer to a disproportionate economic hardship.

First, lead phasedown at the refinery: schedule a drop in the lead standard from 1.1 gram to .5 by January 1, 1988. This represents a sharp reduction in lead content and will move well toward the goal, in combination with retirement of leaded vehicles, in getting the lead out of the environment. Refiners need that amount of time to complete reconfiguration. You have planning; you have the permitting process, including environmental permits, for actual construction. The additional time also gives them a better opportunity to adjust to the large costs involved.

The EPA could put this time to good use by proceeding with its announced intention to review the National Air Quality Standard for lead. Then better information would be available for a more informed decision at that time regarding further cuts.

Second, the misfueling problem: Now, the National Council recognizes that current concern over misfueling is the genesis for much of this renewed debate. A strong economic incentive exists for owners of automobiles designed to use unleaded gasoline to use leaded gasoline. This committee is now looking at the leaded issue, and we understand that the chairman of the committee intends to provide time to mark up Superfund reauthorization legislation in the near future. The House bill on that issue contains provisions which would raise about $1½ billion annually from the petroleum industry by increasing the tax on crude oil and putting a tax on BTX in gasoline.

Now, if in the final judgment of Congress new taxes are necessary for that purpose—and we will have more to say on that at a later date—the National Council would like to offer a proposal which could address both the misfueling issue and Superfund revenue needs, simultaneously in a more equitable manner; and that is, apply an excise tax on leaded gasoline at the retail pump equivalent to the current retail price differential, about 6 cents a gallon, between leaded and unleaded gasoline.

This would discourage retailers from using leaded gasoline as a loss leader and would eliminate the economic incentive to misfuel. It would raise about $2.2 billion based on 1983 data. Of course, that would decline with the phasedown of leaded sales. Application of the existing Federal excise tax exemption to gasoline for off-highway uses would prevent disproportionate economic harm to farmers.

This Senator sits on both committees that would have jurisdiction on this issue.

Senator DURENBERGER. What was that last line? You weren't going to have it happen to farmers, it was just going to happen to everybody else?

Mr. VAN ARSDALL. No. There would be an exemption for off-highway use, since the lead in the environment is not an on-farm issue. It's a high-density environment issue. And the farmer would still be paying taxes for his on-highway purchases of leaded gasoline.

Senator DURENBERGER. Yes, you.d find a way to get rid of that one, too, I am sure.

Mr. VAN ARSDALL. Well, we'd like to work toward that, but I don't think that would quite be possible.

But you can catch the general gist of what we're talking about.

Senator DURENBERGER. I supported the notion once, and it lost 61-28 on the floor of the Senate.

Mr. VAN ARSDALL. In conclusion, the ag community is not the source of the lead problem. Yet the farmers can be subjected to severe adverse impacts by any solution that's carelessly constructed. And I know you have been sensitive to that.

The cooperatives, at considerable cost, have complied with national standards to date, even though those markets have never had the concentrations of lead that have been the focus of actions by Congress and the EPA.

We are not opposing the ultimate objectives of the program. We are, rather, asking that they be accomplished in a manner which minimizes unnecessary costs in efficiencies and inequities.

Thank you.

Senator DURENBERGER. Thank you very much, Tom. Mr. Zanotti.

STATEMENT OF MARTIN P. ZANOTTI, EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER, SABER ENERGY, INC.

Mr. ZANOTTI. Thank you, Senator.

Saber Energy, Inc. is an independent refiner that has constructed a refinery which was able to produce all unleaded gasoline. And we strongly concur with the findings as outlined in section 2(a) of your Senate bill S. 2609.

Also, we feel that the date should be moved ahead to January 1986 instead of 1988, and if for any reason this cannot be done, we would recommend that the committee immediately consider the imposition of a tax on leaded gasoline and restrict the importation of leaded gasoline.

We feel that refiners have now had over 10 years to prepare for lead phasedown. Saber and many other independent refiners have proved that the production of all unleaded gasoline is possible, it just takes a substantial investment.

The current situation is, of course, aggravated by the misfueling. We see four basic ways of reducing this misfueling. One is to have the EPA, by currently authorized rulemaking procedures, to further restrict the use of lead in gasoline at the refinery and at the import level. The current discussion centers around one-tenth of a gram of lead per gallon of leaded gasoline.

Should this cause a—due to the octane costs, should this cause leaded gasoline to be more expensive to produce and even more expensive than the current unleaded gasoline, we would encourage

the EPA to act in a timely manner on a new rule to achieve the one-tenth gram of lead per gallon that's as soon as possible.

The second way would be for Congress to make it unlawful to sell or to offer for sale or introduce into commerce leaded gasoline. We would prefer this route because there are fewer possibilities for exceptions, also because refiners have had an adequate time to build unleaded gasoline facilities.

Third, Congress can increase the tax on leaded gasoline sales to eliminate this incentive for misfueling. This option would also produce revenues.

Fourth, the inspection of all vehicles and the suspension of operating license of those that have been misfueling or tampering with their automobile. This would be extremely expensive to implement.

The EPA is the most effective and expeditious route to control lead usage in gasoline. Based on EPA's misfueling surveys, it is our opinion that lead usage can only be controlled at the point of production or importation of gasoline.

I respectfully encourage the committee to ask EPA to take action immediately.

In summation, we concur with the findings of S. 2609 that lead is a health hazard. We recommend that Congress change the effective date of the bill to January 1, 1986. If you cannot accelerate this removal date, then we advocate that Congress block or attack the importation of leaded gasoline and tax the sale of leaded gasoline to remove the economic incentive for misfueling.

Above all, whatever is done, we would recommend it apply equally to everyone with no special exemptions for one refiner over another be given.

I thank the committee for allowing me to speak today.

Senator DURENBERGER. Good. Thank you very much for being here.

Mr. Redemer.

STATEMENT OF MICHAEL REDEMER, ENVIRONMENTAL ENGINEER, BEACON OIL CO.

Mr. REDEMER. Senator, good afternoon. My name is Michael Redemer, and I am with a small independent refiner and marketer located near Fresno, CA. However, today my comments are on behalf of the coalition of 12 independent refiners located in the States of California, Indiana, Kansas, Tennessee, and the State of Washington.

I would like to address the concerns that this coalition has with regard to the bill that you have introduced, S. 2609, and the regulatory proposals that have been under consideration by the Environmental Protection Agency.

The first point I would like to raise is that the timetable, as reported in the press, that the Environmental Protection Agency was considering looking at was a January 1, 1986, deadline for one-tenth gram per gallon lead in leaded gasoline. It's our concern that this 18-month timetable would not give small independent refiners that needed to construct new facilities the time necessary to do that.

With the current case in California, the Environmental Impact Report process, new-source review regulations, and, in some cases, emission offsets, we're looking at a timetable on the order of 3 to 4 years.

The second point I would like to make is that current state of the market in terms of the gasoline retail market right now and the impact on the independent refiners. In the case of Beacon Oil Co., in 1980 we completed a project to expand our reforming or octane upgrading capacity. And at that time we projected that the market for leaded gasoline would be pretty well on the decline between 1988 and 1990, and we planned for that type of situation.

However, conditions have become even more unsettled in the last few years, 2 years. And as a result, in the last 6 months we've had five refineries close down in California. Of those five, two of the companies have filed for bankruptcy, and of the two, one of them had made a major expenditure to upgrade the bottom-of-the-barrel material in their particular facility.

So it gives you an idea of the market situation and the financial problems that some independents are going to experience trying to finance new construction.

I guess the point I want to make is there is a need for some time flexibility, which your proposal addresses better than the proposals that we have been hearing from the Environmental Protection Agency.

The third point is that in California the air resources board has been, to date, the most stringent regulator of lead in gasoline. In fact, as of October of this year, all the refiners in California, as well as importers and blenders, are required to meet an eight-tenths of a gram per gallon standard and must report every gallon of gasoline that we sell or blend over that level.

California has also been fairly aggressive in promoting inspection and maintenance, and misfueling rates as reported by the air resources board, are on the order of 2 to 5 percent in California, as opposed to numbers in the neighborhood of 12 to 13 percent nationwide.

I would encourage this committee to seek legislation to support programs to prevent tampering. And I commend the Senator for his efforts in that area to deal with tampering and misfueling.

Independent refiners recognize that the market is going to continue to shrink for leaded gasoline, but we would like to see the market processes create the reduction with some sort of a phased-in reduction in the total lead levels in gasoline.

We also recognize that there will be some residual demand for leaded gasoline for some of the early model autos, trucks, and possibly some other vehicles.

As regards to other methods of boosting octane, Beacon Oil is one of the largest sellers of gasoline with ethanol on the west coast, and have been very successful at blending ethanol and marketing it through our 150-plus retail outlets. However, this has been made economical as a result of Federal tax subsidies and also a State of California tax subsidy. The loss of those subsidies could jeopardize that or make that less attractive in terms of the economics.

I might also point out that some of the other refiners that I represent today do not have their own marketing outlets, and the

people that they do have to sell their gasoline though sometimes will not accept the alcohol blends in their gasoline. So this would provide a problem for them in terms of trying to utilize ethanol.

I understand that EPA is in the process of modifying the ambient air quality standards for Lead. And what we would like to see is that process be carried out, that the air quality data nationwide be reviewed, and that that be the driving force behind a further reduction of lead in gasoline.

In the interim, we would suggest for consideration a level of around one-half gram per gallon by January 1988 be considered, and then, based on the analysis that EPA does of the air quality data nationwide and the new standard, possibly further reductions be considered.

Senator DURENBERGER. You are going to have to wind it up.

Mr. REDEMER. Thank you. Even though this bill primarily focuses on health, there are some national energy policy implications. A rapid change in the requirements for lead will help to drive some additional independent refiners out of business, and this, in turn, will throw the refining and marketing capacity into the hands of larger domestic refiners and foreign refiners. In the long run, this will increase consumer prices for these hydrocarbon products and also further shift the control of the energy distribution system into fewer hands.

I thank you for the opportunity to talk to you today.

Senator DURENBERGER. OK. Thank you for your testimony.

Mr. McCowan.

STATEMENT OF ROBERT T. McCOWAN, VICE CHAIRMAN, ASHLAND OIL CO.

Mr. McCOWAN. Thank you, Senator. I am very delighted to be here.

Ashland wants to state our position. We're in favor of the early elimination of lead for motor fuel, and we commend you for having this hearing and taking the position you have.

As you know, Ashland is the Nation's largest independent petroleum refiner and marketer and a leading supplier of independent marketers. We have three refineries today. We have a refinery at Catletsburg, KY, St. Paul, MN, and Canton, OH. And the refining capacity of those total refineries is 332,000 barrels a day.

I just want to give you a little background as to our position on this matter. Back years ago when we were talking about pollution in the industry and exhaust from automobiles, we were skeptical at that time. But in 1974, after the Clean Air Act was passed and the EPA required the marketing of unleaded gasoline, we embarked on a large capital expenditure program, designing our refineries to make high-octane gasoline without lead.

Now, we've done that. And in 1982 the EPA curtailed the lead content of gasoline to the 1.1 grams per gallon. Now, that was with the hope that we could phase out lead over a period of time. But as we know, we have fallen far short of that, for a number of reasons. One primarily is the misfueling that we have talked about much here today. But following the EPA's initial decree on lead phasedown, Ashland Oil spent over $250 million in new refinery equip-

ment, virtually to take the lead out of gasoline and supply the product.

Now, this really never came about. But I want to give you some examples of what our company has done and what's occurred during this period.

In 1981, Ashland Oil invested $16 million in an isomerization unit in our St. Paul refinery. Now, this is a unit designed to take straight-run gasoline low-octane components and make it into high-octane components so that you can make high-octane gasoline without lead.

Gentlemen, we have never started that unit up, simply because there wasn't the demand for unleaded gasoline there to justify it. That equipment is sitting there with the cobwebs on it, never started up.

In Canton, OH, we built the reformer that cost us $21 million, and that reformer has run well under capacity ever since it was built, simply because the demand for unleaded gasoline never reached the projections that they were scheduled on in the phasedown.

These unused investments are a burden to our competitive position, and the units themselves do virtually nothing toward solving the urgent national health problem of removing lead from the environment.

We have also invested with some others in the construction of a 4,000-barrel-a-day ethanol plant at Southpoint, OH, that produces high-octane blendstocks from corn. That plant has never reached its potential, and has never made a profit.

In short, we are convinced that there is a great deal of unleaded gasoline capacity today sitting idle because there is not enough market for the products it produces.

In our opinion, a phasedown of lead content should be the five-tenths of grams per gallon in leaded gasoline could be achieved by January 1, 1985, and a further reduction of one-tenth of a gram per gallon no later than January 1, 1986. And all standards adopted should be equal for all refiners and blenders. Any special exceptions would only serve to defeat the objective we have been trying to get to for the last 10 years.

It would be ironic—and this should be for imported products, too, because it would be ironic if domestic refiners were mandated to make a high investment to take the lead out of gasoline while foreign refiners could import high-lead-content gasoline because they don't have the equipment to take the lead out.

Gentlemen, the time has come to take the lead out, and we stand here to help you and this committee and EPA any way we can to move that process along.

Senator DURENBERGER. Thank you for your statement.

Mr. Redemer, you have now presented me with a problem because on either side of you are members of your industry who, whether you believe all the health stuff or not, have taken it upon themselves to make the investments in taking lead out of gasoline. And leave all the health out of it, if you will. And you've got me in the position where you're saying, on behalf of all the folks that didn't make those decisions, "I don't want you to take the lead out."

Now, I have exaggerated that just a little bit. You've said, "Give us time," and all that sort of thing. But the realities are that Ashland does have that investment sitting idle. It is costing them money because every pump in this place has an artificial differentiation between leaded and unleaded gasoline. And we can play around here forever with, "Put a tax on it, do this and all that sort of thing," but the reality is that a part of your industry, you know, sees the direction the country is going and they have capitalized the appropriate investment to get there.

Now, just tell me why, you know, either they're wrong or why the rest of the industry—are these two of those "bigness" folks that you worry about that they're going to gobble up all the control over price-competitive fuel in this country? Or what is your position?

Mr. REDEMER. Well, I think that to look at the oil industry as a uniform structure is—you know, there are a lot of different interests out there, and I think that the people I represent generally tend to be the smaller independent refiners today.

Senator DURENBERGER. Give me an example in terms of refinery capacity of what you're talking about.

Mr. REDEMER. Well, on the back of my testimony I have listed the 12, and the largest capacity, I think one of them has 60,000 barrels-per-day total per stream day crude capacity. In the case of Beacon, we have about an 18–19,000 barrels-per-day refinery, which produces really about a third of the gasoline that we market through our marketing outlets.

Senator DURENBERGER. Is that the totality of your response?

Mr. REDEMER. Well, I guess so. I—you know, I think, as I said in the case of Beacon, we did anticipate that eventually the market is going to disappear for leaded gasoline. I think our original projections were looking around 1988 to 1990, in that timeframe. The proposals we've heard coming from EPA call for a lot earlier date than that, and that causes us some concern.

Senator DURENBERGER. Tom?

Mr. VAN ARSDALL. Well, Senator, I won't pretend to speculate on the motives of the other witnesses, but I might draw some——

Senator DURENBERGER. You do represent part of the refining industry, don't you?

Mr. VAN ARSDALL. Yes, I do. We have five refineries within our system. And our own internal review showed that from the refiner's perspective only, the decision on whether this thing should be speeded up or not was a function of whether they had excess octane capacity. Some of our members do, some don't.

But I think one key point is that all the refiners have followed the rules of the game as have been established by the EPA. They have met the lead standards that have been phased down. Now we're talking about making rules changes by regulatory fiat in midstream. And there may be good reasons for doing that, but we hope that they would be defined and structured in a way that doesn't put some folks out of business.

And another difference, I guess, within our system is that our customers are owners, and those customers need leaded fuel now and well into the future. I described that system to you briefly. And they are paying for the costs of lead phasedown now in terms of refinery reconfiguration to meet the various lead levels, like the

1.1, as owners of those refineries in a nonprofit system. So I would hope that you would take that into consideration.

Senator DURENBERGER. But if all of your owners think in terms of, "Don't take my lead away from me or I won't be able to drive my tractor," and you can't counter that except with the argument that EPA is being inconsistent in phasing out unleaded oil, then I can see where we have a large problem because you're not a company where the president makes all the decisions.

Mr. VAN ARSDALL. No. Well, that letter spoke for us, I think, in certain regards. But we're not saying don't take the lead out. We're saying proceed judiciously, deal with the misfueling problem if you need to, and get the lead out, but recognize that there is a capital investment out there that a lot of people don't have the money to adjust to right now—including farmers—and recognize that side effect as you look for solutions.

Senator DURENBERGER. Let me ask you, Mr. Zanotti, or you, Mr. McCowan, how we handle the problems we've heard about today of the farmers and the outboard motors and the old cars and all that sort of thing. If we get this down too low or get it too close to zero, is there any incentive for any refiner to stay in the lead business at 0.1 or at any other point, or do we just say goodbye and substitute a different lubricant or a different octane enhancer or whatever is appropriate?

Mr. ZANOTTI. I think eventually it will be some other substitute. In the meantime, if there is a market out there for a product, somebody is going to make it. It may cost a little more, as all leaded gasoline will cost more. As we reduce the lead, the costs for that gallon of leaded gasoline is going to go up, and therefore that's going to be what helps reduce the switching problem.

I think there will be gasoline with a low lead level in it as long as it's allowed by law.

Senator DURENBERGER. Are we talking about each refinery having a small capacity to produce leaded gasoline, or are we talking about just one or two or three who can afford to stay in the business? What do you expect it's going to look like?

Mr. ZANOTTI. Well, I think everybody can afford to stay in the business because if we're doing it now and we have the capacity to go all unleaded, it's really backing off a step to leave some leaded in there. But I think everybody will have the capacity. The distribution may take some working out. But it's something that can be done.

In the meantime, as long as we go to this intermediate of attempts, if that's the minimum, it gives time to do this. And we're talking, even with your bill as it's now structured, if we went to a tenth next year, we still have 3 more years, or 2 years—3 years to solve these other problems.

I might make one other point. We didn't have it in our testimony, but for the record, we have a 50,000 barrel-a-day refinery, a heavy oil refinery.

Senator DURENBERGER. Very good.

Well, I thank all of you very much for your testimony. As I indicated, there will be questions to follow this up. I apologize for the fact of your having to stay here 4 hours to be heard.

Thank you very much.

The hearing is adjourned.

[Whereupon, at 1:25 p.m., the committee was recessed to reconvene at the call of the Chair.]

[Statements submitted for the record and the bill S. 2609 follows:]

STATEMENT OF
BERNARD GOLDSTEIN
ASSISTANT ADMINISTRATOR FOR
RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

JUNE 22, 1984

Mr. Chairman and Members of the Committee. My name is Bernard Goldstein, and I am Assistant Administrator for Research and Development in the U.S. Environmental Protection Agency (EPA). I am pleased to serve on the present panel to discuss health effects associated with lead exposure, with emphasis on newly available research findings and research needed to help close gaps in our knowledge. I am accompanied by Dr. Lester Grant, Director of EPA's Environmental Criteria and Assessment Office in Research Triangle Park, North Carolina. Dr. Grant and his staff have been responsible for Agency evaluations of lead health effects in connection with their preparation of a revised criteria document for lead.

Introduction

The Agency's evaluation of lead-induced health effects will serve as a basis for the Congressionally mandated periodic review of criteria and, as appropriate, revision of the National Ambient Air Quality Standard (NAAQS) for lead. The health effects evaluations are being presented in an updated, revised draft of the EPA document, Air Quality Criteria for Lead, which was

originally issued in 1977, and which provided the scientific basis for establishing the 1978 NAAQS for lead[1]. The health evaluations in the revised draft criteria document also are being drawn upon as inputs to analyses carried out in support of decisionmaking concerning the phase down or banning of lead in gasoline.

Of crucial importance for the setting of the NAAQS for lead and, also, for decisions on what further steps to take regarding lead in gasoline, is the characterization of health effects associated with lead. Lead exposures of children are of particular concern in view of their being one of the population groups most at risk for lead-induced health effects. It is not possible, in the time available here, to provide a comprehensive review or critical assessment of all of the available literature concerning health effects associated with pediatric lead exposures. For such detailed treatment, I refer you to the first external review draft of the revised Lead Criteria Document released by the Agency in late 1983 for public comment. In this testimony, I will focus on one key issue, that of defining so-called "safe" exposure levels for lead, and some important health information bearing on that issue.

Children are exposed to lead via many environmental media and routes, including food, water, air, and dust. There are various ways to index the overall exposure or internal dose of lead resulting from the absorption of lead from various sources and media. The most commonly used index is blood lead levels, which are thought to reflect in a general way lead concentra-

tions in many other tissues of the body. The use of blood lead (PbB) as an index of internal exposure is not perfect and has some drawbacks, but it is nevertheless the most widely used exposure index employed in the screening and treating of children for lead intoxication. A key factor in decision-making, both for setting the NAAQS for lead and regarding the phase down of lead in gasoline, has been the definition of a "maximum safe blood lead level."

For example, in setting the 1978 NAAQS a "maximum safe blood lead level" for pediatric exposure was defined based on the evaluation of exposure-effect or dose-response relationships for lead-induced health effects contained in the 1977 criteria document.[2] Major attention focused then on data useful in delineating lowest-observed effect levels for two categories of lead-induced health effects: (1) hematopoietic and heme synthesis effects; and (2) central and peripheral nervous system deficits. EPA concluded then that the maximum safe blood lead level for any child was 30 ug/dl. This was based, in part, on identification in the 1977 document[2] of young children ($\leq$ 6 years old) as the population group most at risk for lead health effects and the need to select a PbB level providing some margin(s) of safety below PbB concentrations associated with unacceptable medical risk for adverse pediatric health effects. The 30 ug/dl level was distinctly lower than PbB concentrations associated with the following clearly adverse effects: (1) reduced hemoglobin synthesis (starting at 40 ug/dl and, ultimately, resulting in frank anemia by 70 ug/dl),

and (2) cognitive (CNS) deficits and peripheral nerve dysfunction (interpreted as occurring at 50-60 ug/dl), as well as signs and symptoms of life-threatening encephalopathy (starting at 80-100 ug/dl). Indicators of impaired heme synthesis, e.g., erythrocyte protoporphyrin elevations and ALA-D inhibition, were viewed with concern in 1978 as pathophysiological effects but not taken as being adverse health effects, per se, at PbB levels below 30 ug/dl.

Reevaluation of the Health Effects Data Base for Lead

The health data base concerning lead effects has expanded considerably with the publication of many new findings since the preparation of the 1977 EPA lead criteria document.[2] EPA's tentative evaluations of lowest observed-effect levels for several key categories of health effects (as per the 1983 draft of the revised lead document)[4] are summarized in Table 1. Effects noted in Table 1 are among those thus far focused on most intently in relation to EPA's reevaluation of health criteria for the lead NAAQS. Still additional effects are emerging as focal points of debate based on preliminary examination of papers recently submitted or accepted for publication since the 1983 draft document was prepared. Some of these newer studies are mentioned later.

Reevaluation of earlier available studies and newly emerging data have confirmed 1977-78 EPA conclusions concerning lowest-observed-effect levels for hematopoietic (blood cell formation) and heme synthesis effects. The degree of concern associated with EP evaluations and other signs of impaired heme synthesis detected at levels below 30 ug/dl, however, is heightened in light of (1) new evidence indicative of heme synthesis being impaired in other soft tissues (e.g., brain and kidney), possibly in parallel with blood erythrocyte protoporphyrin elevations, and (2) other data demonstrating alterations in additional important physiological processes or organ systems indicated in Table 1 as occurring at 30 ug/dl PbB or below.

37-670 O - 84 - 6

TABLE 1. 1983 DRAFT LEAD DOCUMENT[4] EVALUATION OF OBSERVED EFFECT LEVELS FOR PEDIATRIC LEAD HEALTH EFFECTS

Blood Lead Levels (ug/dl)	Hematopoietic And Heme Synthesis Effects	Nervous System Effects	Other Biochemical Effects
80-100		Encephalopathy Signs And Symptoms	
70		Frank Anemia	
50-60		Cognitive (CNS) Deficits	
40	Reduced Hemoglobin Increased Urinary ALA	Peripheral Nerve Dysfunction	
30		CNS Electro-Physiological Alterations	
15-20	Increased Erythrocyte Protoporphyrin		Vitamin D Metabolism Interference
10	ALA-D Inhibition		Py-5-N Activity Inhibition

Note: The stated types of health effects are interpreted as having been observed with reasonable certainty at the blood lead levels indicated to the left. Arrows indicate uncertainty concerning lowest-observed-effect levels for certain effects, in light of evidence suggesting that the indicated effect may occur, in the absence of any detected threshold, at still lower blood lead levels seen among the particular study populations.

The determination of credible exposure-effect relationships for nervous system effects, especially those occurring at subencephalopathic levels, has been the subject of much greater discussion and controversy than the hematopoietic and heme synthesis effects. Reevaluation of earlier available studies, and examination of more recently reported analyses concerning the effects of lead on IQ or other neurobehavioral performance measures in covertly lead-intoxicated children, have thus far led to the conclusion that lead is likely associated with cognitive deficits in such children at PbB levels in excess of 30 ug/dl. The available data concerning cognitive and behavioral effects at levels below 30 ug/dl are much less clear, however, especially in light of rapidly accumulating findings from very recent studies. Some of these have found no significant associations between lead and IQ or other behavioral measures even before potential confounding variables are taken into account and others found patterns of effects, albeit reduced in magnitude, indicated as replicating effects reported at higher lead exposure levels. Nerve conduction velocity studies, including some newly available since 1977-78, are clearly indicative of peripheral nerve dysfunction at PbB levels as low as 30 to 40 ug/dl or, possibly, somewhat lower. Peripheral nerve effects and other neurobehavioral effects indicative of CNS dysfunction mentioned above as occurring at blood lead levels exceeding 30 ug/dl have previously been accepted as representing adverse health effects. Of less clear medical significance are certain CNS electrophysiological effects (altered EEG patterns and brainstem auditory evoked potentials) observed in preschool children with PbB levels ranging from about 0 to 30 ug/dl.

Other important health effects newly demonstrated to be associated with lead exposures starting below 30 ug/dl PbB include pyrimidine-5-nucleotidase (Py-5-N) activity inhibition and vitamin D metabolism interference. The Py-5-N inhibition effect, observed in children at blood lead levels extending (without evident threshold for the effect) to below 10 ug/dl is a matter of current debate as to its medical significance in light of considerable reserve capacity of the enzyme remaining at blood lead levels below 20 to 30 ug/dl. Of much clearer medical concern, however, is the inhibition of vitamin D metabolism demonstrated in children to be associated with blood lead levels extending down (without evident threshold for the effect) to as low as 12 to 15 ug/dl PbB. This is of particular concern because: (1) vitamin D metabolism interference reflects impairment of important physiological processes in the kidney; (2) the metabolism of vitamin D is crucial in regulating the uptake, absorption, and utilization of calcium and several other essential elements needed for normal growth and development of many different organ systems (as occurs rapidly in young children); and (3) increasing interference with vitamin D metabolism may result in a cascading effect of increasingly greater lead uptake and retention as PbB levels approach or exceed 20 to 30 ug/dl (due to altered availability of calcium and other essential elements that reduce lead absorption and retention). The degree of vitamin D metabolism interference representing an adverse health effect remains to be determined, but is very likely associated with PbB levels well below 30 ug/dl.

The ultimate implications of the current reevaluation of health effects associated with lead exposure cannot yet be fully envisioned. Much remains to be done in completing the reevaluation within the context of updating and revising the Air Quality Criteria Document for Lead. That task is being complicated greatly by the rapid pace of publication of new studies of much relevance to the reevaluation as the criteria document updating process proceeds. It is quite likely, in fact, that still additional effects recently reported or expected to be published shortly will become focal points for attention and debate (as well as the effects already discussed) before the reevaluation process is finished. Let me mention a few examples of some of the new data that will need to be dealt with.

New Research Studies and Findings

First, some new findings should be emphasized that are emerging from analyses of data from the Second National Health and Nutrition Evaluation Survey (or NHANES II study), which obtained health measures on children and adults selected to form a nationally representative sample of the U.S. population during 1976 to 1980. Of particular interest here are results, to be published shortly, which demonstrate that elevations in diastolic blood pressure in adults were associated with PbB levels across a broad spectrum of values, ranging down to below 10 ug/dl. These findings suggest that

potentially serious health effects may occur in a very large segment of the adult population of the U.S.—a group not previously seen as being at risk for health effects associated with ambient lead exposures. Highlighting these findings is not meant to imply any less concern for pediatric lead effects; such findings do, however, help to illustrate a broadening of current concern about ambient lead exposures to population groups in addition to young children and, also, to health effects in addition to blood and nervous system effects previously seen as the critical effects associated with low level lead intoxication.

Other new findings, recently discussed in Cincinnati at an EPA-sponsored international workshop on prospective studies of pediatric populations, should also be mentioned here. The workshop focused on major long-term studies in the U.S. and abroad concerning health effects associated with in utero lead exposures (before birth) and post-natal lead exposures during early childhood. Among results reported at that meeting and just recently published were findings of minor congenital anomalies in newborn infants being associated with umbilical PbB levels (averaging below 10 ug/dl) obtained at the time of delivery for mothers at a Boston hospital. The same research group, headed by Dr. Needleman who is also on the present panel, further reported at the Cincinnati workshop that neonatal delays in pediatric neurological and behavioral development were associated with low level lead exposures. Other studies discussed at the workshop are also expected to yield information on congenital anomalies or delays in neurological and behavioral development possibly associated with low level lead exposure

of the unborn fetus and/or young infant. However, it should be noted that the ultimate significance of any developmental delays detected early in life cannot be fully understood in the absence of follow-up measures in the same children of intellectual and behavioral performance at later time points, during both preschool and schoolage years.

I should also mention that one of the major on-going studies of health effects associated with pediatric lead exposures is being conducted by the Neurotoxicology Division of EPA's Health Effects Research Laboratory. That laboratory is within the Office of Research and Development under my overall direction. EPA scientists, in collaboration with the University of North Carolina Medical School, have been conducting the subject study now for more than 6 years via a cooperative agreement. The study has provided evidence for brain wave pattern changes and alterations in brain stem auditory evoked potentials being associated with blood lead levels in preschool children across a range of approximately 8 to 30 ug/dl. Some of the effects observed when the children were 2-3 years old were found to persist upon follow-up five years later but others were not.

Lastly, let me note the need for Federal agencies to support conferences and other types of meetings at which our in-house scientists and their peers elsewhere in the U.S. and abroad can interact and benefit from each other's insights. We at EPA plan to sponsor such forums for presentation and discussion of lead-related health effects periodically during the next several years.

Potential Implications of Lead Health Effects Reevaluation

Despite difficulties associated with evaluation of a rapidly expanding lead health effects data base, several implications of the current reevaluation already appear to be evident. First, increasing evidence is accumulating that is indicative of health effects of concern occurring at lead exposure levels previously considered to be "safe" (i.e., in association with PbB levels below 30 ug/dl). To the extent that such evidence exists, and continues to mount in the coming months, considerable momentum is gathering toward revising the 30 ug/dl PbB "safe" level downward. This is likely to be reflected most immediately by the redefinition of Centers for Disease Control (CDC) guidelines for childhood lead toxicity screening programs [5] whereby some lower PbB level (less than 30 ug/dl) will be stated as a recommended medical intervention level signalling the need for: (1) follow-up blood sampling and analysis; (2) identification and elimination of exposure sources; and (3) possible treatment for lead toxicity. Lowering of the intervention level from 30 to 25 ug/dl PbB was recommended by an advisory panel of health experts at a recent (May, 1984) CDC meeting in Atlanta. Selection of the 25 ug/dl level was based, in part, on practical considerations and, as the advisory panel emphasized, is not to be taken as representing a completely "safe" PbB level (in the sense that certain health effects of concern may occur at PbB levels even below 25 ug/dl).

As for the ultimate impact of the current reevaluation of lead health effects on EPA regulatory decision making, much remains to be seen. Further revision of the draft Criteria Document for Lead is underway and the new draft is expected to incorporate discussion of new findings of the type outlined earlier. That revised draft will be reviewed by the Clean Air Scientific Advisory Committee (CASAC) of the Agency's Science Advisory Board. CASAC is a Congressionally-mandated committee, made up of non-EPA scientific and air pollution control experts, which provides independent review of air quality criteria documents and other aspects related to the setting of ambient air standards. The selection of any specific PbB concentration representing a "maximum safe blood lead" level will be arrived at only after further review of the revised lead Criteria Document by CASAC in late fall and any associated proposed rationale for revising of the Lead NAAQS as presented in a draft staff paper prepared by the Office of Air and Radiation. In the meantime, current Agency evaluations of lead health effects have confirmed the appropriateness of EPA's goal of removing lead from gasoline. Recent evaluations by other EPA offices of costs and benefits associated with further phasedown or total banning of lead in gasoline found net monetary benefits to be associated with decreasing gasoline lead usage. It is important to emphasize that those calculations of benefits included monetized estimates only of benefits expected for avoidance of health effects associated with blood lead levels > 30 ug/dl. None of the new types of effects discussed here as being reported at PbB levels < 30 ug/dl was monetized, though they are of concern and provide additional support for reducing lead in gasoline.

Thank you, and I will be happy to answer any questions.

References

1. F.R. (1978 October 5) 43:46246-46277. National ambient air quality standard for lead: final rule.

2. U.S. Environmental Protection Agency, Health Effects Research Laboratory (1977) Air Quality Criteria For Lead. Research Triangle Park, N.C.: U.S. Environmental Protection Agency, Criteria and Special Studies Office; EPA report No. EPA-600/8-77-017. Available from: NTIS, Springfield, VA; PB 280411.

3. The Clean Air Act as amended (1977) 42 U.S.C. 7408(c), 7409(d); 108(c), 109(d).

4. U.S. Environmental Protection Agency. Air quality criteria for lead: v1. I-IV. [External review draft]. Research Triangle Park, NC: U.S. Environmental Protection Agency, Environmental Criteria and Assessment Office; EPA report No. EPA-600/8-83-028A. Available from: NTIS, Springfield, VA; PB84-144591.

5. U.S. Centers for Disease Control. (1978) Preventing lead poisoning in young children: a statement by the Centers for Disease Control. Atlanta, GA: U.S. Department of Health, Education, and Welfare; publication No. 00-2629.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333

FOR RELEASE ONLY UPON DELIVERY

STATEMENT OF

VERNON N. HOUK, M.D.

DIRECTOR, CENTER FOR ENVIRONMENTAL HEALTH

CENTERS FOR DISEASE CONTROL

PUBLIC HEALTH SERVICE

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

ATLANTA, GEORGIA

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

JUNE 22, 1984

I am Dr. Vernon N. Houk, M.D., Director, Center for Environmental Health, Centers for Disease Control (CDC) of the Public Health Service. I am pleased to be here this morning to discuss the association of blood lead levels and gasoline lead levels. I am accompanied by Dr. James L. Pirkle of my staff who has extensively reviewed the question of the sources of lead in children.

One of the major advances in the last 10 years has been the improved understanding of the contribution of air lead to the multiple routes of human lead exposure. The three major population-wide sources of lead exposure in the United States are lead in gasoline, lead in paint and lead in solder. In addition to these general sources, occupational exposures are important for persons associated with lead-related industries. These sources of lead use the pathways of air, water, food, paintchips, dust and dirt to reach children and adults. Gasoline lead leaves the tailpipe and is temporarily suspended in air. Gasoline lead accounts for about 85% of all air lead. Subsequently, it falls from the air onto water, dust, food crops, and dirt; contaminating drinking water and the food chain. Children and adults are then exposed to gasoline lead by breathing, eating and drinking, and especially children through the normal hand to mouth activity that transfers dust and dirt into their mouths.

I will now discuss several recent studies which have investigated the relationship between gasoline lead and blood lead levels. One nationwide study is the second National Health and Nutrition Examination Survey (NHANES II) which was conducted from February 1976 through February 1980. The National Center for Health Statistics coordinated the sample collection and data acquisition of the survey and the Centers for Disease Control performed the blood lead measurements. The survey consisted of a detailed medical

history and physical examination along with a battery of laboratory tests including a blood lead level. The survey was designed to be representative of the civilian noninstitutionalized U.S. population ages 6 months through 74 years for the period of 1976 to 1980. Blood lead samples were obtained from 9937 persons across the United States over the four year survey period.

Analysis of these blood lead samples indicated that from February 1976 to February 1980, mean blood lead levels in the United States decreased 37% (from 15.8 to 10.0 micrograms per deciliter). In addition, the blood lead levels showed significant seasonal fluctuations with higher levels found in the summer as compared to the winter. These findings were also present in the separate analyses of population subgroups defined by race, sex, age, income, degree of urbanization and region of the country.

General exposure to lead in paint and soldered food cans changed very little over the survey period. However, lead in gasoline decreased approximately 50% over the four years of the survey from about 196,000 tons per year to 94,000 tons per year. Figure 1 shows lead used in gasoline and average NHANES II blood lead levels over the survey period. Multiple regression analysis revealed that the 50% decrease in gasoline lead usage could fully account for the 37% decline in blood lead levels. In addition, the seasonal fluctuations in blood lead levels were explained by the seasonal fluctuations in gasoline lead usage. Seasonal fluctuations in blood lead levels had been noted in previous studies, but this is the first time they have been able to be adequately explained. So, the gasoline lead/blood lead relationship that explained the overall four-year decline in blood lead levels also explained the increase in blood lead levels that occurred from winter to summer months.

For children 6 months through 5 years old, six-month mean blood lead levels were highly correlated ($r = 0.95$) with six-month mean gasoline lead levels. This high correlation did not appreciably change even after accounting for the effects of almost every conceivable variable that might influence blood lead levels. The probability that chance accounts for the relationship between mean blood levels and gasoline lead is less than 1 in 10,000.

The NHANES II blood lead results also predicted that the average length of time that a change in blood lead levels would lag behind a change in gasoline lead exposure was approximately one month. This lag time of one month agreed very well with the 30 day half-life of lead in the blood which was determined independently by isotopic methods.

In addition to the NHANES survey, the New York City and Chicago lead screening programs have measured the blood lead levels of a large number of children. Analysis of the blood lead levels of New York City children from 1970 - 1976 showed a strong association ($p < .0001$) between gasoline lead and blood lead. Just as with the NHANES II data, gasoline lead usage not only explained the decline in blood lead levels of the New York City children but also explained the short-term seasonal fluctuations in blood lead levels.

Similar results were found when the blood lead levels of black Chicago children were analyzed for the period 1976 through 1980. As with the NHANES II data and the New York City screening data, gasoline lead was strongly associated ($p < .0001$) with blood lead levels in these black children and the seasonal fluctuations in blood lead levels were explained by the seasonal

fluctuations in gasoline lead usage. In addition, the Chicago data showed the same biologically plausible, one month lag time between changes in gasoline lead usage and changes in blood lead levels that was found in the NHANES II analysis.

Another large study was conducted in Boston on 11,837 umbilical cord blood lead levels between April 1979 and April 1981. A definite downward trend and seasonal pattern in blood lead levels was noted over the time period. Average monthly blood lead levels were strongly associated with local monthly gasoline lead usage ($p < .001$). As with the NHANES and Chicago screening data, the best association was between gasoline lead and one-month-lagged blood lead levels. The implication of gasoline lead as a significant contributor to umbilical cord blood lead levels is noteworthy since the yet unborn child is probably the most vulnerable to the neurotoxic effects of lead.

The NHANES II study, the New York City lead screeni data, the Chicago lead screening data and the Boston umbilical cord blood lead data are four large, independent data sets, each demonstrating the same strong relationship between gasoline lead usage and children's blood lead levels. In each of these studies, gasoline lead usage not only explained long term decreases in blood lead levels but simultaneously accounted for the short-term increases in blood lead levels that occur from winter to summer months.

The length of time that a change in blood lead levels lags behind a change in gasoline lead exposure was calculated independently for the NHANES II, Chicago and Boston data sets. Each data set predicted approximately a one month lag time which agrees very well with the 30 day half-life of lead in the blood measured by isotopic methods.

The excellent agreement of the results of these four independent studies strongly supports a causal relationship between changes in gasoline lead usage and changes in blood lead levels.

In an effort to quantitate the amount of lead in human blood which comes from gasoline, a large scale field study called the Isotopic Lead Experiment was undertaken in Italy in 1974. The gasoline in an entire region of northern Italy was 90% replaced with gasoline which contained lead from a foreign source that could be isotopically traced. The amount of gasoline lead that entered humans could therefore be measured without having to track the lead through the various routes of entry: air, water, dust, dirt and food. The most reliable calculations were made for 35 adult participants. Gasoline lead was found to contribute at least 5 to 6 micrograms per deciliter to blood lead levels. Complete data sets were not available for children but the available data indicated that the contribution of gasoline lead in children would probably be higher than adults.

Estimates from the NHANES II blood lead data predict that gasoline lead contributed approximately 8 micrograms per deciliter to blood lead levels, which is in good agreement with the results of the isotopic lead experiment. For a typical child in the United States, current gasoline lead exposure probably accounts for 25 to 50% of the child's total blood lead level. However, in pockets of excessive gasoline lead exposure this contribution is likely to be higher.

Calculations from CDC's lead screening program (based on data from 1972-1980) indicate that if there had been no lead in gasoline from 1977 through 1981, there would have been approximately 80% fewer cases of lead toxicity during that time period. That is, 80% of the children found to have lead toxicity required contributions from both gasoline lead and non-gasoline lead sources to reach toxic levels.

Compounding the gasoline lead exposure problem is the fact that the gasoline lead that is dispersed into the environment accumulates. General lead accumulation in environmental reservoirs from gasoline and non-gasoline lead sources has already amassed to such a degree that typical adult body burdens of lead in the U.S. are about 500 times higher than those of persons who lived in the pre-industrial era. Even though the amount of lead in gasoline has been reduced, as of the beginning of 1984, gasoline lead was still being dispersed into the U.S. environment at a rate of 33,000 tons per year or 4.1 tons per hour.

In summary, current evidence leaves little doubt that gasoline lead is a major controllable source of lead exposure for children. Substantially decreasing the amount of lead in gasoline would not only significantly decrease lead levels in children but could also decrease the background lead exposure for future generations.

LEAD USED IN GASOLINE PRODUCTION AND AVERAGE NHANES II BLOOD LEAD LEVELS (FEB. 1976 – FEB. 1980)

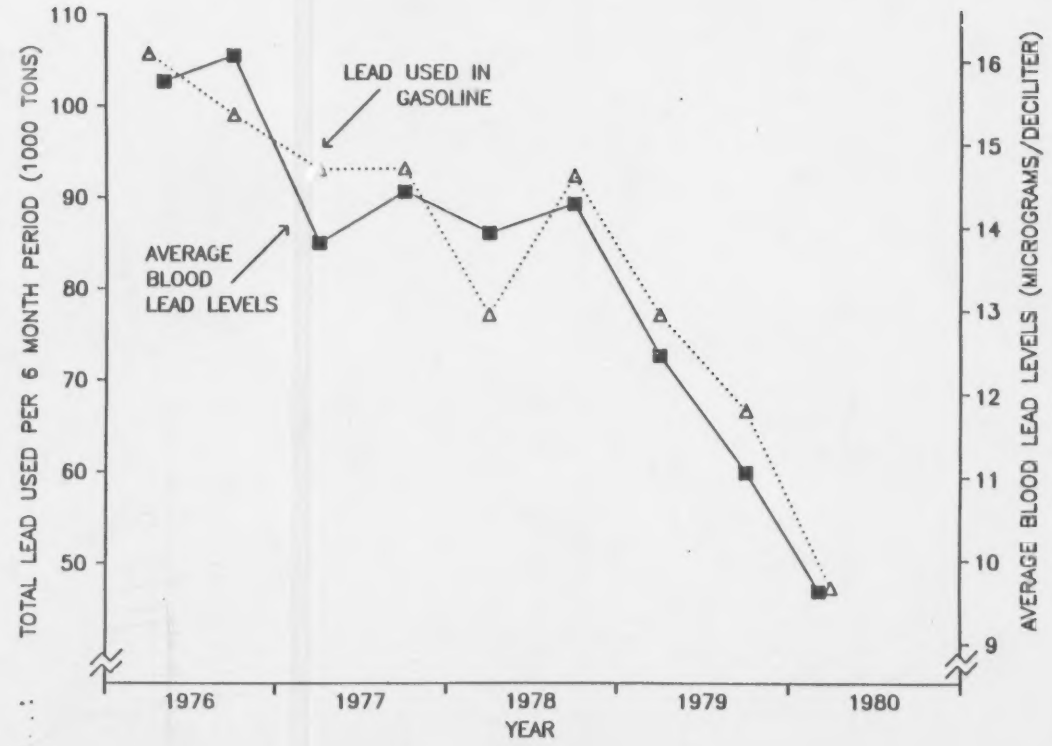


FIGURE 1

TESTIMONY OF HERBERT L. NEEDLEMAN MD

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

WASHINGTON DC

JUNE 22, 1984

Good morning Mr. Chairman:

I am Herbert L. Needleman MD, Associate Professor of Child Psychiatry and Pediatrics at the University of Pittsburgh. I am Chief of Behavioral SCiences at the Childrens Hospital of Pittsburgh. I wish to speak in support of S. 2609. I believe this is one of the most important public health measures for American children in this decade.

The effects of lead on human function have been known since the time of the ancients. Throughout history these warnings about lead have been regularly ignored. One can find comments on lead's toxic properties in Egyptian papyruses, and Pliny the Elder warned of the hazards of breathing lead fumes. Despite this, the Romans persisted in using lead in construction and water conveyance. It has been suggested that the declining birth rate and increased incidence of madness in the Roman upper class was related to the use of lead in sweetening wine, and that this was a factor in the fall of the empire.

We have known about the sources of lead, its toxicology and the necessary steps to remove this hazard from our environment for a long time. That we have not acted in step with the pace of our scientific knowledge is a commentary on our society's willingness to make the hard decisions. I congratulate Senator Durenberger for taking the leadership in this most pressing issue.

I shall attempt to review the health effects of lead for this committee in capsule form. In doing so, I shall concentrate on the work of myself and my colleagues, but I don't want to convey the impression that the burden of proof of lead's toxicity at low dose depends only on the data drawn from the studies of my group. There is a considerable and constantly growing body of knowledge collected from studies all over the world, derived from human investigations, buttressed by animal experimentation that testifies to the extent of lead's toxicity. There is a growing consensus among lead scientists and public health authorities that lead is among the most serious of public health problems, that children are the most vulnerable target group, and that the more sensitive methods one brings to bear on the subject, the more likely one is to find effects at lower doses. Oppposition to this point of view comes in the main from lead industry executives and their spokesmen from the academy.

HOW COMMON IS EXCESS EXPOSURE TO LEAD? A recent study from the National Center for Health Statistics, National Health and Nutrition Examination Survey II, demonstrates that 4% of American children between the ages of 6 months and 5 years have levels of lead in their blood in excess of 40ug/dl. The Center for Disease Control has defined an excess blood level in childhood as over 30ug/dl, and is currently in the process of redefining that level down to 25ug/dl. At 60ug/dl, unequivocal poisoning is observed. I know of no other poison in which a safety margin of 60% or 50% is deemed acceptable.

This exposure has both a class and race bias. Poor white children are nine times more likely to have high level of lead in their blood than more fortunate youngsters(6% vs 0.7%) Black children of low family income are at the highest risk; 18.6% have excess amounts of lead in their blood. This means that almost 700,000 children of all races and socioeconomic status have high blood levels.

WHAT ARE THE SOURCES OF LEAD FOR HUMANS? I will not dwell on this topic at length. It is clear that an important source is lead in the air and in dust as a result of airborne fallout. We have shown that the monthly mean unmbilical cord blood level in newborn infants, before they have had a chance to eat, or to breathe more than a few breaths, is highly correlated with the monthly sales of leaded gasoline in the state of Massachusetts(Rabinowitz and Needleman, 1983). This finding corresponds quite closely to the CDC data derived from the NHANES work. As sales of leaded gasoline declined, the mean blood lead levels dropped in close correspondence.

WHAT IS THE EVIDENCE THAT LEAD AT LOW DOSE IS TOXIC? The first study to suggest this was reported by Dr. Randolph Byers in 1943. Byers followed up children who had recovered from lead intoxication, half of whom had no signs of brain involvement. Nineteen of 20 were found to be behaviorally or cognitively impaired. Since the symptoms of intoxication -- headache, malaise, bellyache, and clumsiness -- were nonspecific, Byers questioned how many cases of lead intoxication were missed and later turned up as behavior disordered or learning impaired. He was prophetic. Years later those investigators who have follwed him have begun to estimate the costs. The numbers are troubling.

EPIDEMIOLOGIC STUDIES OF LEAD AT LOW DOSE: I had treated a good deal of lead poisoning as a resident in pediatrics in Philadelphia, and when I went into community psychiatry in the inner city, found that the most pressing problems reported by teachers, principals and parents were mental retardation, learning disabilties, and bad classroom behavior. I wondered whether any of this was due to unrecognized lead poisoning. My

colleagues and I developed a way to look back into the lead exposure of children: measuring the lead in deciduous teeth. We showed that lead levels in the teeth of lead poisoned children were much higher than in normal children, and that levels in children who were considered normal, but who lived in the area where poisoning was endemic, had disturbingly high levels. We found that 20% of these children had levels in the toxic range.

With my coworkers from the Boston Children's Hospital and Harvard Medical School, financed by a grant from the NIH, we collected shed deciduous teeth from over 2,000 first and second grade children. It is important to note that all of these children had been identified by the schools as not lead poisoned, and not cognitively impaired. We measured the lead in their teeth and then compared the children's neuropsychological performance in the high and low lead samples, controlling for 39 other variables which could have affected their development. Among these variables were mothers' and fathers' education, socioeconomic status, parents' IQ, birth weight, and child's health history. After controlling for these variables, we found that children with higher amounts of lead in their teeth were significantly impaired on their IQ scores, on measures of auditory and language functioning, on attention, and on classroom behavior as rated by their teacher(who did not know their students' lead levels).

It is important to note that while the difference in means between the groups was four points, the risk of being severely impaired, defined as having an IQ score below 80, was quadrupled.

When we examined the teachers' ratings on all 2,146 children in the school sample, we found that there was a regular, smooth increase in the number of unfavorable reports in direct relation to the amount of lead in their teeth. There was no evidence of a threshold. This study received a great deal of attention when published, and a group of British scientists was funded to repeat it because there was a great deal of scepticism in certain quarters of the British establishment. They found a similar decrease in IQ scores related to lead level, and the same pattern of teachers' ratings(Lansdown, Yule, et al, 1983). Similar data has been reported by German investigators(Winneke, et al, 1983).

The growing consensus is that children with excess lead in their bodies, but who do not have symptoms severe enough to bring them to medical attention are likely to experience deficits in their intellectual and behavioral functioning. This is an issue accompanied by considerable controversy. Most of the controversy has been engendered by the lead industry and their academic consultants, who maintain that the evidence for low lead effects is flawed or inconclusive. The major opposition to the thesis that lead at low dose is harmful to infants and children does not

come from pediatricians, or from public health specialists, but from the industry and its representatives.

The lead industry, and certain academic critics have raised canons for proof that are impossible to fulfill in real world studies. In this regard their behavior resembles the tobacco industry, which still maintains, in the face of overwhelming evidence, that the health case against smoking is not proven. This issue takes us into the realm of epistemology -- how do we know what we know. Permit me a short digression to pursue the question.

What constitutes proof of a causal relationship? Since the 18th century it has been clear that causality is a concept not subject to empirical demonstration. David Hume, the Scottish philosopher, established this quite clearly, and this fixed limitation is recognized in most modern textbooks of epidemiology. What epidemiologists really attempt to do is to pile up incremental bits of evidence about the likelihood of a relationship's real world existence, gleaned out of the consistency and coherence of many studies. They do not expect any single study to "prove" a causal relationship. And where observational studies cannot offer complete control of the variates under examination, they turn to models from the animal laboratory to fill the lacunae. But this widely acknowledged epistemic constraint is employed, cynically I believe, to diminish the contribution of existent studies to our state of knowledge and to the decision making process.

The bulk of studies published since Needleman et al 1979 converge on the conclusion that lead at doses experienced by ostensibly asymptomatic children is associated with decreased IQ scores. Some of these do not reach significance at the 0.05 level, but when the studies are combined in the analysis, and the probability of such an outcome calculated, the chances of this series of events occurring by chance are vanishingly small. Schwartz et al, in a recent EPA report evaluating the cost benefit ratio of eliminating lead from gasoline, have evaluated these studies, both including and excluding my group's data, and find the combined significance of these studies to be very strong. When my data is added into their calculations, the significance reaches truly impressive proportions.

School-age children may not be the most sensitive group for lead. Lead crosses the placenta, and is found in the umbilical cord blood in concentrations correlated to that of the mother. We investigated the importance of this phenomenon in a large study of Boston area mothers and infants. In this study, we measured the relationship of umbilical cord blood lead level to the incidence of malformation, low birth weight , infection and jaundice in 5000 births at the Boston Hospital for Women. We had a detailed profile of socioeconomic, health, and other factors

such as tobacco and alcohol use, and controlled for these covariates. We used stepwise logistic regression to evaluate the effect of lead and covariates, and found that umbilical cord blood lead was related to minor malformations in a dose dependent fashion, controlling for other covariates. I have copies of the preprint available(Needleman et al, 1984).

We have followed a group of these infants forward in time at six- month intervals and measured their intellectual development. This study is now being continued by my colleagues, David Bellinger, Michael Rabinowitz, and Alan Leviton. We have followed forward a sample of 250 children balanced for initial cord blood lead level, and found that umbilical cord blood lead predicts Bayley Mental Developmental Index scores at 6 and 12 months of age, controlling for relevant covariates.

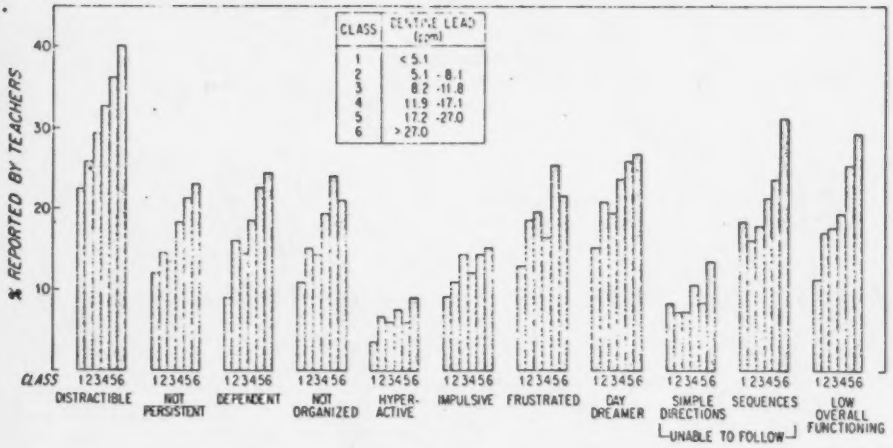
In this study, we evaluated a large number of potentially confounding variables, collecting data on about 120 demographic, medical, perinatal, infant, and environmental variables. We then used bivariate analysis to determine which of these had an impact on development and could confound, and then tested whether including these variables into a stepwise regression model affected the magnitude of the lead parameter estimate. Two factors were found to be potentially confounding: length of gestation, and score on the Caldwell HOME. These two factors were included in the final model, and lead's effect on outcome evaluated. The final regression model with these two confounders showed that lead in the unbilical cord blood had a highly significant relationship to mental development at 6 and 12 months of age. The distributions of lead levels are worthy of this group's attention. The mean blood lead levels for the lowest, mid, and highest groups are 1.8ug/dl; 6.5ug/dl; and 14.6ug/dl respectively. This study has been accepted for publication in a peer-reviewed journal(Bellinger, Needleman et al, 1984).

We are currently studying, under support from the EPA, the monitized costs to families of low level lead exposure. We hope to fix, more precisely than before, the actual costs to families and to society of remedial education and increased medical and psychiatric care of these children. The first step in this direction was taken by George Provenzano, an environmental epidemiologist, who used my data to estimate the costs of remedial education and medical care in children with excess lead exposure. His calculations indicated that the annual costs for this exposure ranged between $700 million and $1.4 billion in 1979 dollars. This estimate may well be conservative, because it was made on the basis of earlier and lower prevalence estimates than the NHANES data.(Provenzano, 1981)

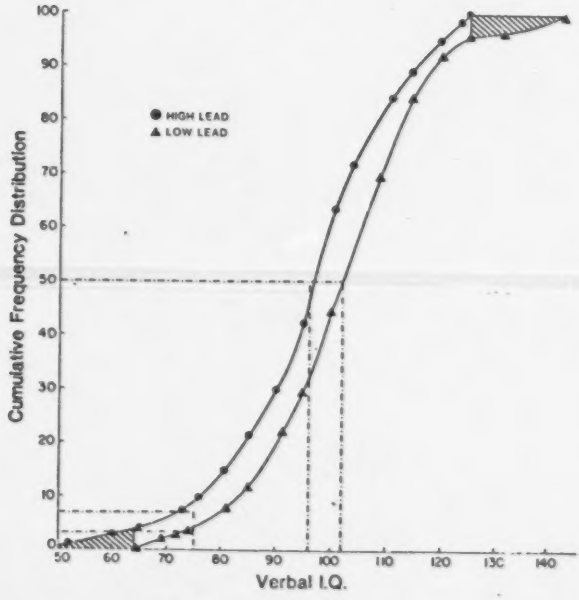
A prudent and neutral evaluator of this body of data could not escape the conclusion that low dose lead affects childrens brains, that forward studies of lead show an effect on later

development and on the incidence of minor malformations. The larger mystery is why our society has been so slow to recognize this threat, and to deal with it promptly and effectively. I congratulate the authors of this bill for seizing the leadership.

Thank you for yor attention. I am ready to answer any questions that you might have.



TEACHERS RATINGS IN RELATION TO DENTINE LEAD LEVELS



CUMULATIVE FREQUENCY OF I.Q. SCORES IN HIGH AND LOW LEAD GROUPS

REFERENCES

1. Rabinowitz, M., Needleman, H. Petrol lead sales and umbilical cord blood lead levels in Boston, Massachusetts. Lancet 1:63, 1983.

2. Lansdown, R., Yule, W., Urbanowicz, M., Millar Blood lead, intelligence, attainment and behaviour in school children: overview of a pilot study. In: Lead Versus Health, M. Rutter and R. Jones (eds.), John Wiley & Sons, Chichester, 1983.

3. Winneke, G. Neurobehavioural and neuropsychological effects of lead. In: Lead Versus Health, M. Rutter and R. Jones (eds.), John Wiley & Sons, Chichester, 1983.

4. Needleman, H., Rabinowitz, M. Leviton, A., Linn, S., Schoenbaum, S. The relationship between prenatal exposure to lead and congenital anomalies. Journal of the American Medical Association 22:2956, 1984.

5. Bellinger, D., Needleman, H., Leviton, A., Waternaux, C., Rabinowitz, M., Nichols, M. Early sensory-motor development and prenatal exposure to lead. Neurobehavioral Toxicology. (In Press).

6. Provenzano, G. Social costs of excessive lead exposure during childhood. In: Low Level Lead Exposure: The Clinical Implications of Current Research, H. Needleman, (ed.), Raven Press, New York, 1980.

BEFORE THE
U.S. SENATE COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS

TESTIMONY OF JEROME F. COLE, Sc.D., PRESIDENT
INTERNATIONAL LEAD ZINC RESEARCH ORGANIZATION, INC.
ON S.2609

My name is Jerome F. Cole. I am President of the International Lead Zinc Research Organization, Inc. (ILZRO) with offices in New York City. ILZRO is the research arm of the international lead and zinc industries. For two decades ILZRO has sponsored a program of environmental health research aimed at defining the health and environmental impact of the production and use of lead, zinc and cadmium. I am appearing here today at the request of the Lead Industries Association (LIA), the trade association for the U.S. lead industry. LIA was invited by the Chairman to participate on this panel. Based on my own experience and the research data which we have generated I am pleased to provide input on S.2609 regarding lead in gasoline.

With me is a consultant to ILZRO, Dr. Robert Bornschein. Dr. Bornschein is a psychologist, a researcher, and expert on studies pertaining to the neurobehavioral effects of lead. Dr. Bornschein, who is an Associate Professor at the University of Cincinnati, is intimately familiar with the scientific studies pertaining to the neurobehavioral effects of lead. Dr. Bornschein is here to respond to any questions you may have pertaining to his area of expertise.

The research ILZRO and others have conducted indicates that the lead that was once used in paint and is still present in old, deteriorating housing, is far and away the primary cause of elevated blood lead levels in children.

However, the U.S. Government has largely blinded itself to this fact and has concentrated its attention on the reduction of lead in the ambient air which the studies show is, at worst, a minor contributor to the problem. While we believe the Government has been aiming at the wrong target, the fact is that U.S. policies have already resulted in a reduction of almost 70% in air lead levels and there will be further reductions without any Governmental action. We can't see the need for additional Federal regulations or laws that would require an immediate end to the use of lead in gasoline.

Lead has been used in gasoline for over 60 years. Over that time, despite extensive research efforts on the part of industry, academia, and government, there is no evidence that anyone in the general public has been harmed by this usage. Because of the introduction of catalytic converters and lead free gasoline in U.S. cars in the early 1970's, and regulations limiting the amount of lead in leaded gasoline, the use of lead in gasoline in the U.S. has dropped by over 70%. This usage is projected to decline further as the older cars requiring or tolerating leaded gasoline are eventually phased out. In short, there never has been evidence that we had a problem with the use of leaded gasoline. And even if we did, lead usage has already declined by 70% and in the normal course of things will be reduced to a de minimus level in only a few years.

We are aware, of course, of the claims and arguments of those who would further restrict or ban the use of lead in gasoline. These generally include:

a) an inflated estimate of the contribution of leaded gasoline usage to lead absorption as measured by the concentration of lead in blood.

and,

b) a one-sided and alarmist view of the medical and health evidence pertaining to the impact of low level lead exposure.

Over the years there have been a number of studies which have attempted to estimate the contribution of lead in gasoline to lead in blood. Unfortunately, virtually none of these studies have been definitive. However, the picture which emerges is that the contribution of gasoline lead to blood lead is relatively small. One of the most recent reviews of these studies was prepared by Dr. Peter Elwood of the U.K. Medical Research Council Epidemiology Unit in Cardiff, Wales. (A copy of this review is attached to this statement). Dr. Elwood's conclusion is as follows:

> "On current evidence it is impossible to make a reasonable estimate of the total contribution of petrol lead to blood lead. Estimates of the relationship between air lead and blood lead suggest that only a small proportion of blood lead can be attributed to airborne petrol lead. The contribution from petrol by routes other than air is unknown but is also likely to be small."

Dr. Elwood is highly critical as are we of the two studies which have suggested that the contribution of gasoline lead to blood lead is relatively large. These studies are the so-called ILE (Isotopic Lead Experiment), carried out in Italy, and the NHANES II time trend analysis here in the U.S. The ILE study is so fraught with errors that it simply cannot be used. At the end of this massive study, the conclusion that the contribution of lead in gasoline to blood lead may be as high as 27% rests on data from only 12 subjects - two traffic wardens, seven industrial workers and three subjects grouped as "students, office workers, housekeepers, etc." All other data had to be

discarded.

The NHANES II data shows a correlation between the reduction of lead in gasoline usage over the period 1976-1980 with a reduction of lead in blood over the same period.

Now, it is, true that gasoline lead levels declined over the period and it appears that blood lead levels also declined. However, to suggest that all or even most of the decline in blood lead was caused by a reduction in gasoline lead, as has been implied, is simplistic and dangerous. It is simplistic because the analysis ignores the impact of other, concurrent private and regulatory initatives to reduce lead exposure. It is dangerous because erroneously attributing such a great proportion of the blood lead decline to a single source endangers other programs which are far more meaningful in terms of reducing the likelihood of lead poisoning in children.

We would refer you, once again, to the report by Dr. Elwood for specific criticisms of the use to which the NHANES II data have been put. Further we would refer you to a report which was prepared by an independent peer review group at the request of the U.S. Environmental Protection Agency. This NHANES II Time Trend Analysis Review Group reviewed the analysis from a statistical standpoint. (Report Attached) While, in a narrow sense, the Review Group confirmed the correlation between gasoline lead and blood lead, it noted:

> "... the survey results and statistical analyses do not confirm the causal hypothesis"

This Review Group strongly warned against using the NHANES II data for estimates of the impact of gasoline lead on blood lead beyond the limits of the data - i.e. beyond 1980. Yet that is precisely what was done by the EPA office

of Policy Analysis when it used the NHANES II data to predict the blood lead levels of children in 1988 in its Draft Final Report "Costs and Benefits of Reducing Lead in Gasoline". In warning against extrapolation beyond the four year period of the NHANES II data the Review Group stated:

> "In general, the Review Group would warn that the weaknesses which have been discussed in the context of analyzing relationships within the four-year survey period become enormously greater in any attempt to extrapolate beyond that period."

Earlier I mentioned that the time trend analysis of the NHANES II data was simplistic and also dangerous. A clear example of the danger is the recent Advance Notice of Proposed Rulemaking from the Department of Housing and Urban Development which would significantly weaken HUD's enforcement of the abatement provisions of the 1971 Lead Paint Poisoning Prevention Act. HUD feels justified in doing so because the NHANES II time trend analysis indicates that lead in gasoline, not lead in paint, may have been a major cause of elevated blood lead levels. This position is at variance, however, with the findings of Dr. J. Julian Chisolm, a recognized lead expert and pediatrician from Baltimore. In 1982, Dr. Chisolm noted that, over the period 1976-81, the number of children in Baltimore with increased lead absorption did not decrease. Hence, if lead in gasoline usage had been the cause of elevated blood lead levels, then the number of cases would have been expected to decrease.

The evidence then points strongly to old lead paint and the type of housing as responsible for elevated blood lead levels. By misleading HUD, the NHANES II analysts may well be impeding further needed progress in abating lead paint hazards in older housing in urban areas.

Therefore, we believe that reliable data point to lead in gasoline as a relatively minor source of lead in blood, especially in children with elevated blood lead levels. However, we are aware that there is concern that lead exposure, even at relatively low levels is harmful. Please recognize, though, that lead is not some alien substance created in some chemical laboratory. Lead is an element. It is one of just over 100 fundamental, natural substances that constitute all matter. It is part of the earth and man has always lived with it and adapted to it. Therefore, it is quite normal to have some exposure to lead. If that exposure is low enough, it causes no harm.

We all recognize that at high exposure levels -- those most often associated with children who have ingested lead-containing paint chips -- lead can cause serious illness and even death. However, some have claimed that at very low levels of exposure lead may be associated with adverse health effects. The most provocative and alarming of these claims has been that low-level lead exposure may be associated with behavioral defects and learning disability. The work of Dr. Herbert Needleman is most often cited as support for this premise. This controversial study, which was published in 1979 has received an enormous amount of publicity and accounts for the general perception that low level lead exposure is harmful.

However, in late 1983 an EPA appointed Independent Peer Review Committee conducted a thorough review of Dr. Needleman's work and the work of another researcher, Dr. Claire Ernhart (copy attached). They were critical of both studies. In addition, the Committee examined several other recent relevant studies. Regarding the famous 1979 Needleman study the Committee concluded:

> "In summary, at this time, based on the questionable Pb exposure categorization and subject exclusion methods, problems with missing data, and concerns regarding the statistical analyses employed and selected for reporting, the Committee concludes that the study results, as reported in the Needleman et al. (1979) paper neither support nor refute the hypothesis that low or moderate levels of Pb exposure lead to cognitive or other behavioral impairments in children."

The Committee also reviewed a number of other studies authored or co-authored by Dr. Needleman and found them to be similarly flawed.

The major conclusion of this Committee was:

> "the Committee knows of no studies that, to date, have validly established (after proper control for confounding variables) a relationship between low-level Pb exposure and neuropsychologic deficits in children."

The lesson that we should learn from all of this is that getting a publication in print does not establish it as gospel.

The peer review process that EPA initiated has been valuable for clarifying the real meaning, or lack of meaning, of particularly controversial studies. We would urge that the process be extended to other studies before they are accepted at face value. The EPA peer review process would also provide assistance in clarifying the health meaning of relatively minor biochemical changes which are sometimes correlated with lead exposure. To assume, a priori, that such changes are harmful would, in a general sense, open a floodgate of unnecessary regulation on virtually every substance in our environment.

Quite simply we don't feel that the scientific and medical data at hand warrant a further reduction of the lead content of gasoline. Those who claim that they do are engaging in improper scientific extrapolation.

Mark Twain perhaps best commented on the dangers of scientific

extrapolation. In his Life on the Mississippi, he comments on the "shortening" of the length of the Mississippi river due to cut-offs which straightened the river from its past more meandering course. He wrote:

> "In the space of one hundred and seventy-six years the Lower Mississippi has shortened itself two hundred and forty-two miles. That is an average of a trifle over one mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the Old Oolitic Silurian Period, just a million years ago next November, the Lower Mississippi River was upward of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing rod. And by the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen. There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investment of fact."

(Emphasis Added)

June 22, 1984

STATEMENT

BY

HOWARD W. MIELKE, Ph.D.
DEPARTMENT OF GEOGRAPHY
MACALESTER COLLEGE

MEMBER OF
THE LEAD COALITION
OF MINNESOTA

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

WASHINGTON, DC

JUNE 22, 1984

I am Howard Mielke. I am here as a member of the LEAD COALITION, an organization that represents the concerns of a number of groups in Minnesota including, the Minnesota Chapter of the Audubon Society, the Sierra Club, Citizens for a Better Environment, Clean Air Clean Water Unlimited, Resource Management Center, and MECCA, as well as individual parents, physicians and other concerned citizens. I am pleased to be here to testify on behalf of children from the age of birth to five and unborn fetuses who are at greatest risk to the effects of lead and who cannot testify for themselves. I bring letters of support as well as a resolution from the State Legislature of Minnesota urging an immediate ban on the use of lead as an additive to gasoline.

The lead issue is one of the most alarming, but at the same time solvable issues of our urban society. No issue is more "grassroots" or fundamental than the subject of contamination of children's urban indoor and outdoor play areas daily with thousands of pounds of extremely toxic lead dust. No issue is better known from both research and experience than the lead issue. And yet, the technological city as engineered in the twentieth century has been unwittingly designed and operated to create an accumulation of lead dust within it.

No one argues that lead is not an extremely toxic, yet slow acting poison. Unfortunately, we haphazardly use and disperse lead without regard to the long term consequences of such activities. No one argues that unborn fetuses and children are not the most sensitive to the toxic effects of lead. However, children rely upon adults for responsible public policy to provide a safe environment for their development.

Past efforts in controlling lead exposure to children centered on leaded paints. This source is clearly important and requires continuing attention. The effects of exposure to lead paint intake are striking and the children become acutely sick. Federal regulations are in place to reduce this source of lead to children.

At present the major source of lead that enters the city arrives as an aerosol through the combustion of leaded gasoline. It is now evident that lead aerosols have also been an important source of lead and caused much more serious health problems to children than were previously suspected. Lead aerosol particles become part of the dust and soil of the ambient environment. And children, who crawl on the floors and ground become continually exposed to lead as they suck their fingers and mouth toys that become continually contaminated with lead dust from aerosol sources.

In aerosol form, lead is essentially tasteless, odorless, and invisible to the naked eye. There are two principal locations that experience high lead aerosol levels in our society; around primary and secondary lead smelters and within major urban areas. Presently, in Minnesota, secondary smelters emit about 10,000 pounds of lead per year

while motor vehicles emit about 2,000,000 pounds per year. Because traffic is concentrated in urban areas, they have been subject to higher lead aerosol accumulations than have locations around lead smelters. This point is illustrated in the Appendix to this statement of a study comparing a neighborhood with a secondary lead smelter and an inner-city community, both in Minneapolis.

No one argues that the use of leaded gasoline is not the single most important emission source to enter the urban environment but Federal law prohibits states and municipalities from acting on their own behalf to eliminate this source of lead. While there have been reductions in lead in gasoline, considering the magnitude of the source, the progress has been slow and inconsistent. For example, changes in Federal standards in 1982 caused a significant (15-20% in Minnesota) increase in lead aerosols in half the states of the union.

The effects of low levels of lead exposure, levels that presently contaminate the ambient air, dust and soils of major cities, are so subtle as to escape ordinary attention. These effects include learning disabilities, lowered IQs, behavioral disorders, and increased sickness and disease. With young children, we have hope and dreams, but because they are only beginning to mature there is no prior record of their abilities. Thus, it is difficult to recognize the impact that environmental lead contamination has on the individual child.

The Lead Coalition has printed two reports by Patrick Lee Reagan concerning health hazards ("Hazards of Lead to Children's Health: The Case Against Leaded Gasoline") and the damaging effects that lead has on emissions, performance and maintenance of motor vehicles ("The Effects of Fuel Choice on Motor Vehicle Emissions, Engine Performance and Maintenance Costs"). The public costs far outweigh the public benefits and there is no public justification for continued use of lead in gasoline.

The lead issue is of concern to everyone who is a parent, lives in a city, has interest in the education of children, or is interested in the future of our society. The capacity of our society to grow and evolve is vested in the future abilities of our youngest citizens. It is the children who will benefit the most when we as a nation decide that our cities require environments that are unburdened by toxic levels of lead.

The Lead Coalition applauds the efforts of the Committee on Environment and Public Works in considering a ban on leaded gasoline. However, the seriousness of the problem requires a more timely schedule than 1988. Why does one more generation of children need to be unduly exposed to the dusting of cities with lead? Waiting four more years will not protect the present children between the ages of birth and five, and as yet unborn fetuses, from excessive exposure to lead. Also, the Lead Coalition finds no engineering or economic justification for the exclusion loophole that has been written into the bill and

thus, we prefer the language of the House bill, HR 5084. On the basis of present information, and with the understanding that the society that cares for the needs of its children is the society that has the best prospects for a viable future, we urge you to act to eliminate leaded gasoline, the remaining major source of lead contamination of our urban environment. Raising the children of this nation in lead contaminated urban environments is a serious matter that requires deliberate and uncompromising remedial action by a responsible adult population.

I am prepared to answer questions you may have at this time.

APPENDIX

LEAD EXPOSURE TO HUMAN POPULATIONS: A COMPARISON BETWEEN A COMMUNITY WITH A SECONDARY LEAD SMELTER AND AN INNER CITY NEIGHBORHOOD IN MINNEAPOLIS.

Research Directed by Howard W. Mielke, Ph.D.
With the Assistance of Bruce Blake
And Funded by Private Donations to the Lead Coalition.

"Sometime in the near future it probably will be shown that the older urban areas of the United States have been rendered more or less uninhabitable by the millions of tons of poisonous industrial lead residues that have accumulated in cities during the past century."

Clair C. Patterson, Ph.D. in Lead in the Human Environment, National Academy of Sciences (1980).

Research in two metropolitan areas, Baltimore and Minneapolis, has shown that the above statement underestimates the amount of contamination that has occurred in urban areas (see references). It is not only the older urban areas but all urban areas where motor vehicles have been fueled with leaded gasoline that have become contaminated with lead. Lead is an extremely toxic, slow acting poison. Children, because of their developmental needs and hand-to-mouth activity are most sensitive to the effects of lead.

There are two major sources of lead aerosol emissions, lead smelters and leaded gasoline combusted by motor vehicles. The following study conducted in Minneapolis illustrates the impact that the two types of lead aerosol sources have had on the quality of the urban environment.

The communities chosen for study were selected on the basis of the lead aerosol sources that they contained. Berry Street is a neighborhood that is the site of a secondary lead smelter. Cedar Riverside is an inner city residential community that is noted for its Federally subsidized high-rise apartment complexes. The two communities differ in many respects. Berry Street has a low population density and Cedar Riverside is one of the most densely populated areas in Minneapolis. The Berry Street community with the lead smelter is located between University Avenue and I-94 and is bordered on the East by 280. Traffic tends to skirt the community rather than flow directly through it. In contrast, Cedar Riverside has no industry and is nestled between I-35W and I-94 and has high daily traffic flow through it because of its proximity to both downtown Minneapolis and the University of Minnesota.

The soils of both communities were sampled in a systematic manner using the same protocol. The collected samples were prepared and analyzed for their lead content. Table 1 shows the results of the lead analysis for all soils sampled in each community. Although the community with the lead smelter would be expected to be the more contaminated environment, in fact, Cedar Riverside has higher environmental lead contamination. There are Federal standards for lead in air, water and paint, but there are no standards for lead in soils. Several lead guidelines have been proposed for soils. In order to place the results of the analysis into perspective, Table 2 lists the percentages of soils in each community that are above each of the suggested guidelines. Note that in Cedar Riverside, half the soil samples tested had lead levels above the maximum recommended guideline of 400 micrograms of lead per gram of soil for children's play areas; the neighborhood with the smelter had about one fifth of its soils above that same guideline.

The community with the lowest population and least contamination has received the most assistance from state officials to solve community lead problems. The smelter was closed because it was emitting higher levels of lead than were allowed by Federal standards. The state of Minnesota does not recognize the existance of a lead hazard in the Cedar Riverside Community even though the environment is twice as contaminated as the neighborhood around the lead smelter.

Why is the Cedar Riverside Community more contaminated with lead than a lead smelter site? The answer becomes evident when the sources of lead aerosols are examined in detail. In Minnesota, the state regulates secondary lead smelters and other stationary lead sources. These sources emit about 10,000 pounds of lead per year. On the other hand, Federal laws have exclusive jurisdiction over additives to gasoline. In Minnesota, motor vehicles emit about 200 times more lead, or about 2,000,000 pounds of lead per year than lead smelters. The inner city has been subjected to lead accumulations from the immense motor vehicle lead aerosol emissions in direct proportion to the traffic flows which concentrate toward the heart of major cities. The present quantity of lead in gasoline is about half what it was in the early 1970's but they still dwarf all other sources. The measured soil lead levels reflect all lead sources that have influenced an area, both past and present.

In summary, the lead smelter on Berry Street presently emits no lead per week into the environment, while motor vehicles of Saint Paul and Minneapolis emit between 8,000 and 12,000 pounds of lead per week. The daily dust fall of lead in the heart of our most densely populated urban centers is a function of traffic flow patterns and leaded gasoline consumption. Enough lead has already accumulated from all sources in Cedar Riverside to raise serious concerns. The major ungoing source of lead aerosol has been identified as leaded gasoline

and given the magnitude of the source is inadequately regulated, especially in comparison with lead smelters of Minnesota. All lead sources must be controlled in order to cease the accumulation of lead in the urban environment and to meet the children's developmental need for a relatively low lead environment.

References

Mielke, H.W., J.C. Anderson, K.J. Berry, P.W. Mielke, R.L. Chaney and M. Leech. 1983. Lead Concentrations in Inner-City Soils as a Factor in the Child Lead Problem. Am. J. of Public Health 73(12):1366-1369.

Mielke, H.W., B. Blake, S. Burroughs and N. Hassinger. 1984. Lead Levels in Minneapolis: The Case of the Hmong Children. In press, Environmental Research, June issue.

TABLE 1. Comparison of Berry Street and Cedar Riverside Communities. All Samples.

SOIL LEAD LEVELS (ugPb/g soil)

PERCENTILE	Berry Street N=19	Cedar Riverside N=29
Min	41	49
25	140	210
50	180	400
75	310	970
Max	2100	4000

TABLE 2. Percent of Samples with Lead Levels Above Specific Guidelines in the Communities of Berry Street and Cedar Riverside.

GUIDELINES	ug Pb	PERCENT OF SOIL SAMPLES (%) Berry Street	Cedar Riverside
	More than 100	89	90
	More than 300	26	62
	More than 400	21	48
	More than 500	21	34
	More than 600	16	28
	More than 1000	11	21

NOTES

1. 100 ug/g is the maximum permissible lead level in agricultural soils as suggested by the UN Food and Agriculture Organization.
2. 300 to 400 ug/g is the suggested upper lead limit of a soil in which children, who do not exhibit overt pica, should be allowed to play. Reference: Dr. Vernon Houk, Center for Disease control, Atlanta, Georgia.
3. 500 ug/g is the lower limit of the hazardous soil category suggested by the EPA in the Federal Register in 1977. Subsequent research should cause a downward revision of this quantity.
4. 600 ug/g is the present legal standard for the amount of lead allowed in paint as passed by Congress in 1972 and enforced in 1978. Recent medical research suggests this level is too high.
5. Greater than 1000 ug/g. Too hazardous for human exposure per EPA in the Federal Register, 1977. This guideline was written in light of the scientific data as of 1977 and for children at least, too high.

ENVIRONMENTAL RESEARCH 34, 64–76 (1984)

Urban Lead Levels in Minneapolis: The Case of the Hmong Children

HOWARD W. MIELKE, BRUCE BLAKE, SARAH BURROUGHS, AND NANCY HASSINGER

Department of Geography, Macalester College, St. Paul, Minnesota 55105

Received May 16, 1983

This study uses soil lead as a means of describing the urban lead levels in the metropolitan area of the Twin Cities, and assesses the soil lead levels next to homes of neighborhoods of the metropolitan area. Lead levels of rural soils are around 5 μg/g. Near the city limits they increase to 25–50 μg/g, and in the central business district they are around 500 to 1000 μg/g, or over 100 times greater than in the rural areas. Many Hmong children are suffering from undue lead absorption. The homes of the Hmong children were all located in inner-city neighborhoods. Soil around these homes was compared to soils around homes of a neighborhood away from the inner city. Fifty percent of the Hmong children with lead poisoning inhabit homes which have soil lead levels of 500–999 μg/g and 40% live in homes with lead levels of 1000 μg/g or more. One home of ten in the outer city has soil lead levels above 500 μg/g. The lead sources of the inner city include house paint and leaded gasoline from vehicle traffic. Raising children in high lead environments as found in the Minneapolis inner city has long-term implications because of mental and behavioral deficits that are known to result from chronic exposure to lead.

INTRODUCTION

Lead is an extremely toxic substance. Chronic low-level lead exposure has been demonstrated to cause a variety of mental and behavioral disorders (Ratcliffe, 1981). It is especially toxic to children because they absorb and retain about 50% of the lead they ingest as compared with 8% absorption and retention for adults (Hammond, 1982). Thus, it is important to ensure that human populations are not exposed to lead levels that are even remotely close to being hazardous (Needleman, 1980).

The possibility that the soils of all major urban centers in the United States are contaminated with unacceptable levels of lead was a depressing, but major conclusion in a soil lead study conducted in metropolitan Baltimore (Mielke *et al.*, 1983). In that study, a new statistical technique was used to determine the degree of concentration of gardens exhibiting high lead levels. We learned that high lead gardens were clustered near the center of the city and that lead levels decreased markedly toward the outside of the city. Furthermore, the probability of explaining the clustering of high lead garden soils at the center of the urban area by chance alone was less than one in a trillion to the second power (i.e., $P = 10^{-23}$). In scientific work a level of probability of 10^{-23} is almost unheard of. Recognizing that there are few fundamental differences between large cities in the United States, it seemed likely that other large cities would be similar in

their pattern of lead distribution. The measurement of lead accumulations in soil appears to be a useful tool for evaluating the potential lead hazard of the environment.

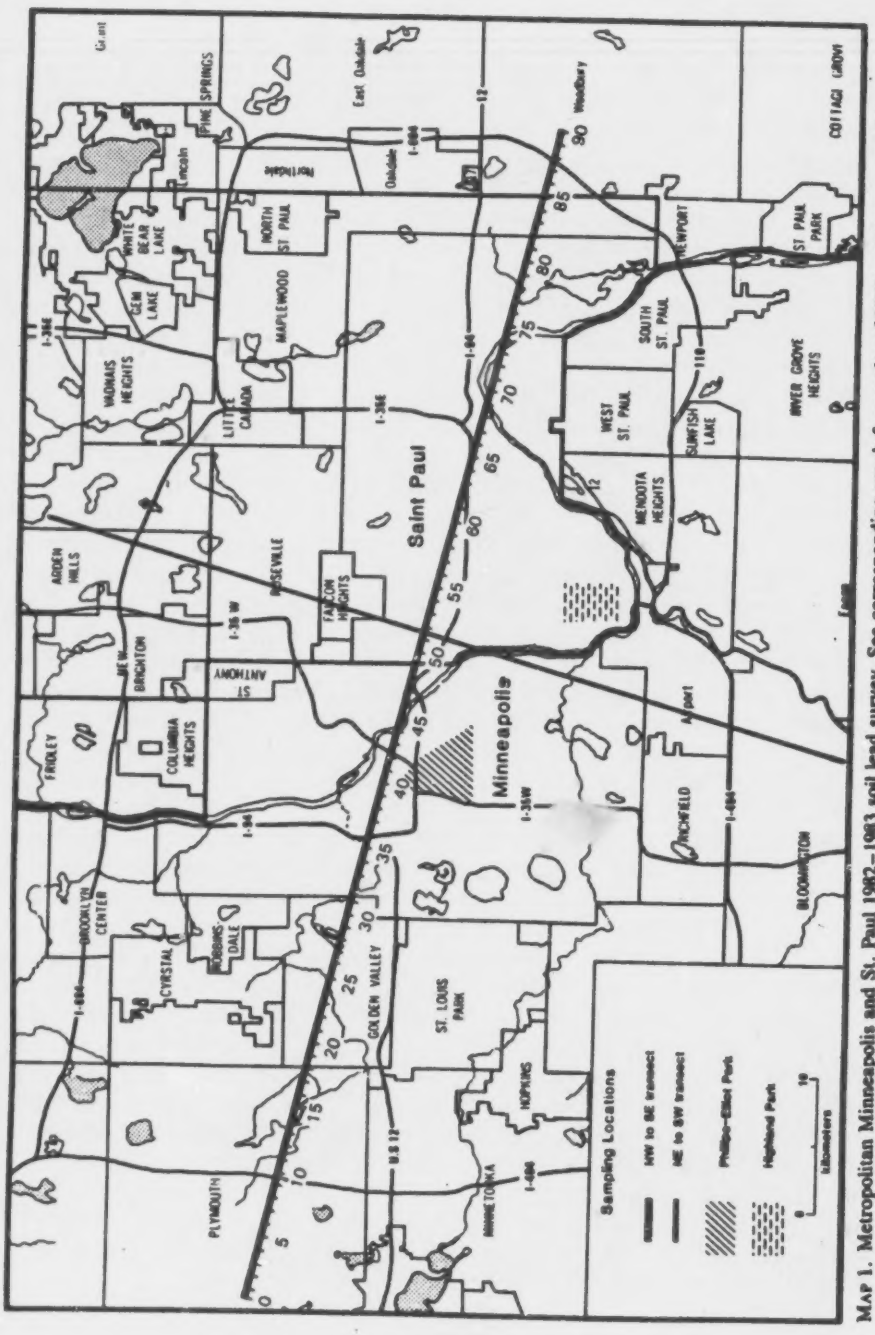
The metropolitan area of Minneapolis generally receives high marks for environmental quality. There are no heavy industries. The average inhabitant is considered to be among the best educated and possesses one of the highest standards of living in the United States. It was our hope that by studying soil lead in metropolitan Minneapolis unexpected differences would be uncovered that would provide a clear explanation for the striking results discovered in Baltimore. We also hoped to explore the efficacy of using soil sampling techniques for evaluating the lead hazards of the city.

The principal approach of this study involved the examination of the soil lead levels in the immediate vicinity of the housing of a group of children who suffered from undue lead insult. Children in the Minneapolis area have not undergone routine blood lead screening. Instead, zinc protoporphyrin is measured in a blood sample using a hematofluorometer in order to assess the levels of free erythrocyte protoporphyrin (abbreviated FEP). When blood FEP levels are equal to or above 50 micrograms per deciliter (abbreviated μg/dl) and ferritin is normal, then lead poisoning is suspected and blood lead is measured. Children with normal ferritin and FEPs moderately elevated from 35 μ/dl to less than 50 μg/dl are not being routinely screened for blood lead. FEPs below 35 μg/dl are considered normal. One group of people in Minneapolis who have received intensive medical attention are the children of the most recent immigrants to the area, the Hmong people. The Hmong are an agricultural people who came from the highlands of Laos. There is no evidence that the Hmong had elevated blood lead levels prior to their arrival in the Twin Cities. From late 1979 through 1981, a number of Hmong children were identified with high FEPs and on further testing were found to have blood lead levels equal to or above 30 μg/dl. The Hmong population of Minneapolis consists of around 2500 people, and a disproportionately high number were identified with undue lead absorption.

The case of the Hmong children raises both medical and environmental questions. The medical questions concern the reason for the disproportionate number of lead poisoning cases found within the population of the Hmong children compared to all other children tested in Minneapolis. The environmental question revolves around the fact that public health officials in Minneapolis were unable to identify the source(s) of lead in most of the lead poisoning cases of the Hmong children. This study focuses on the environmental aspects of the problem.

METHODS

The study of urban lead in Minneapolis involved two different approaches. First, we set out to assess the lead levels within different sectors of the metropolitan area. This part of the study involved the collection of soil samples along transects that passed through a variety of sites at different distances from the center of the city. Collection strategy was planned in advance of fieldwork by using a metropolitan map. On the map, two legs of a transect were drawn. One transect was a straight line approximately northwest to southeast through the



Map 1. Metropolitan Minneapolis and St. Paul 1982–1983 soil lead survey. See corresponding graph for results of NW to SE transect. (Fig. 1).

centers of the central business districts of Minneapolis and St. Paul. The second transect bisected the metropolitan area and ran approximately northeast to southwest. Collection points were marked on the transects at approximately 1-km intervals across the entire metropolitan area from farmland to farmland on both transects. In addition to the large transects for the whole metropolitan area, smaller transects were done within the neighborhoods where house site samples were collected (described below). The soil samples were collected primarily from road right of ways. In all cases we avoided bare soil areas in order to exclude contaminated soils that do not support the growth of vegetation. In the rural areas, soil samples were collected near fences of fields. In suburban and urban areas, soils were collected next to sidewalks. At sites where the grass or other vegetation was continuous, a section of turf was removed, and a sample of soil was collected that consisted of soil knocked from the lower roots of the sod and soil from the layer immediately beneath the sod, i.e., a depth between 5–12 cm.

The second part of the study focused on the immediate home environment of the group of Hmong children who have suffered from lead poisoning in Minneapolis. House sites were chosen on the basis of information gathered by public health clinics in downtown Minneapolis which serve a large proportion of the Hmong population. Our study focused on two subgroups of children. One group was composed of 29 Hmong children who exhibited high FEPs and were positively diagnosed with elevated blood lead levels equal or above 30 μg/dl. The median age of these children is 23 months (range = 13–93 months). A second group consisted of a randomized sample of 40 Hmong children who registered blood FEP less than 35 μg/dl and were regarded as being unlikely to have elevated blood lead levels. Blood lead levels were not measured for the second group of children. The median age of the low FEP children is 21 months (range = 12–93 months). From medical records, the address listed at time of diagnosis was obtained for each child. Housing site soil samples were collected at the front and rear or side entrance of each address. The samples were taken from the most accessible point within a 1-m radius of the corners of the bottom-most step. All of the samples collected in Minneapolis were taken from the top 0–8 cm of soil at points of bare earth or very sparse vegetation. For purposes of comparison, house site samples were also collected from a neighborhood located away from the inner city where no cases of child lead poisoning are suspected. These samples were taken from a similar location with respect to the house, but unlike the Hmong housing the sites were vegetated, hence sampling was done as described above for the transect study, except only surface soil (top 0–8 cm) was collected.

In all cases the samples were air dried and sieved with a stainless-steel (USGS No. 10) 2-mm mesh screen. Samples were prepared by shaking a 1:4 ratio of air-dried soil to 1 M nitric acid extraction solution for a period of 2 hr. The extracts were filtered and the final extractions were analyzed for lead using an IL 357 atomic absorption spectrophotometer with deuterium background correction. Those samples whose lead concentrations exceeded the range of the spectrophotometer were diluted with 1 M nitric acid and reanalyzed.

RESULTS

The results of the transect survey are illustrated in Fig. 1 for the metropolitan area of Minneapolis and St. Paul. The rural soil lead levels are 5 ppm or less.

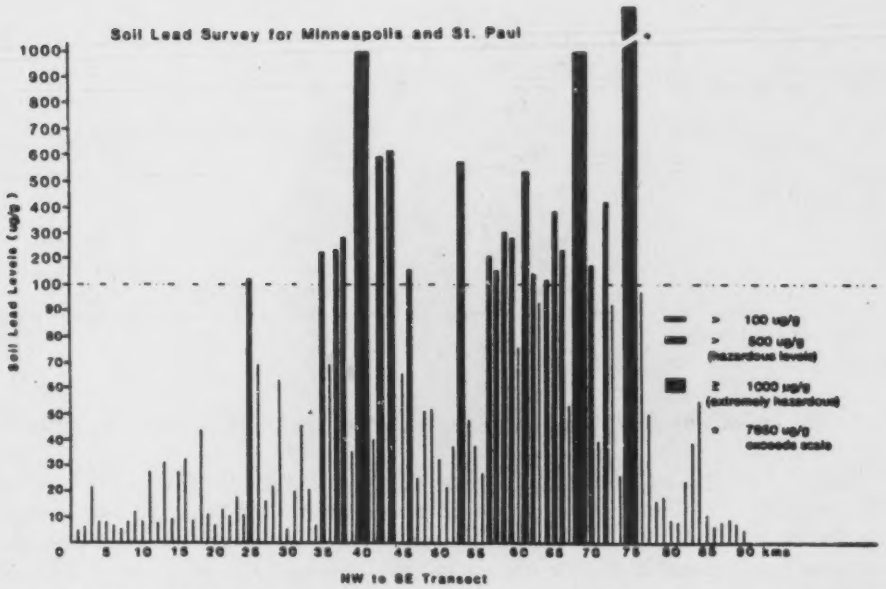


FIG. 1. Distribution graph of 90 samples taken at 1-km intervals. (See corresponding metro map).

Toward the center of each central business district the highest soil lead levels increase markedly. For example, along the transect west of Minneapolis to downtown there is a 10-fold increase in lead near the city limits and again, another 10-fold increase (or an 100-fold increase above the rural lead level) in downtown Minneapolis. The lowest lead levels recorded along the same transect also become progressively elevated toward the center of the city. A major characteristic of soil lead levels along the transect is their variability within the city.

Table 1 lists the results of the right-of-way samples collected within the Phillips and Elliot Park neighborhoods where most of the Hmong children live and the control neighborhood of Highland Park. In both cases right-of-way lead levels show a direct relationship to traffic patterns within the neighborhoods. That is, where traffic is light, lead levels are low, and where traffic is heavy, lead levels

TABLE 1
LEAD LEVELS (μg/g) OF RIGHT-OF-WAY SOIL SAMPLES

Percentile	Phillips and Elliot Park	Highland Park
Lowest	58	21
25	139	53
50	290	72
75	835	161
Highest	1290	440

TABLE 2
SOIL LEAD (μg/g) OF HOUSE SITES INHABITED BY HIGH LEAD AND LOW FEP HMONG CHILDREN AND HOUSE SITES IN HIGHLAND PARK

Percentile	Inner-city houses		Highland Park houses (10)
	Lead cases (21)[a]	Low FEP (28)	
Lowest	275	130	13
25	548	485	34
50	900	737	48
75	1087	1250	64
Highest	6150	1840	848

[a] Number of houses.

ure high. In each neighborhood the highest sample is around 20 times higher than the lowest sample.

Table 2 lists the soil lead results of the housing site study. Given in the table are percentiles of the soil lead levels of houses associated with the two groups of Hmong children living in the Phillips and Elliot Park neighborhoods and the soil lead levels found alongside houses in the Highland Park neighborhood. In all cases, the lead levels of the inner-city houses are between 10 and 20 times higher than the houses in the Highland Park neighborhood.

Comparing the medians of Tables 1 and 2, there are different relationships between the right-of-way and house side lead levels in the neighborhoods of the study. In the inner city, the house side soils have lead levels two or three times higher than the right-of-way soils. In Highland Park, the house side soils (with exception of the highest sample) have levels about half the right-of-way soils.

DISCUSSION

The United States Department of Agriculture Extension Service in cooperation with the Environmental Protection Agency have established working guidelines for lead levels in garden soils (Rufus Chaney, USDA, Beltsville, Md.; Thomas Spittler, EPA, Lexington, Mass., personal communication). These provide a means of assessing the degree of the urban lead hazard associated with the homes of the Hmong children. The guidelines list soils containing lead levels below 500 μg/g of soil as generally safe for gardening purposes and having low-to-medium potential for health hazard to children. Soils with lead levels of 500 to less than 1000 μg lead/g of soil are listed as being potentially hazardous to children due to health risks of soil lead. At lead levels equal to or greater than 1000 μg/g the soils are considered too hazardous for children and replacement or other remedial action is recommended. Vernon Houk of the Center for Disease Control suggested 300 to 400 μg soil lead as the appropriate upper limit (personal communcation). Using the higher USDA-EPA guideline, Tables 3 and 4 provide a perspective on the urban lead situation for the Hmong children of Minneapolis.

In Table 3, the soil lead levels of the homes of the two groups of Hmong children are compared with the homes of the Highland Park neighborhood. Eighty-five

TABLE 3
PERCENTAGE OF HOUSING SITES EXHIBITING VARIOUS DEGREES OF LEAD HAZARD TO HMONG CHILDREN COMPARED WITH HIGHLAND PARK HOUSING SITES

Soil lead (μg/g)	Inner-city houses (%)			Highland Park (10)
	Lead cases (21)[a]	Low FEP (28)	Total (49)	
<500	14(3)	29(8)	22(11)	90(9)
500–999	52(11)	36(10)	43(21)	10(1)
>1000	33(7)	36(10)	35(17)	

[a] Number of homes.

percent of the homes of the Hmong children with diagnosed lead poisoning have soil lead levels that are either potentially hazardous or extremely hazardous according to USDA–EPA working guidelines. This compares with 10% of the Highland Park homes having lead levels in the potentially hazardous category.

In Table 4 the number of Hmong children of the two groups, lead poisoned and low FEP, living in environments exhibiting various levels of lead are shown. Ninety percent of the Hmong children who have blood lead levels equal to or about 30 μg/dl live in environments that have soils listed as either potentially or extremely hazardous. About 78% of the children with low FEP live in environments with soils that are listed as either potentially or extremely hazardous.

In 1978, as prescribed in the Lead-Based Paint Poisoning Prevention Act by Congress, paints were reduced to no more than 600 μg lead/g of paint (Public Law 91-695). However, the leaded paint which was applied to homes remains highly toxic and, unless covered, ends up in the soil. Based on the contribution of leaded paint to the soil, the homes of the Hmong children can be divided into two major types: those with wood, aluminum, or composition siding, and those with brick, stucco, or new construction that have not been painted with lead-based paints. Table 5 compares the housing types and their associated soil lead levels measured in this study.

Fifty-five percent of the home sites measured in this study were wood framed and were most likely painted with lead-based paint. Many of these homes have aluminum or composition siding that has been installed during recent years. The

TABLE 4
PERCENTAGE HMONG CHILDREN LIVING IN HOUSING REGISTERING VARIOUS LEVELS OF LEAD

Soil lead (μg/g)	Hmong children (%)		
	Lead cases (29)[a]	low FEP (40)	Total (69)
<500	10	23	17
500–999	50	40	44
>1000	40	38	39

[a] Number of children.

TABLE 5
SOIL LEAD LEVELS (μg/g) OF PAINTED HOMES COMPARED WITH BRICK AND STUCCO HOMES

Percentile	Painted homes (24)	Brick and stucco homes (20)
Lowest	475	130
25	737	384
50	938	526
75	1253	965
Highest	6150	1840

exterior sidings of these homes have probably been painted, scraped, and repainted several times during the life of the homes with paint containing up to 300,000 μg lead/g of paint. Forty-five percent of the homes in the study were of brick or stucco construction. In Table 6, the residences of the two groups of children are compared.

Of the 21 residences housing children with lead poisoning, 16 or 76% of the homes were painted and five or 24% were of brick and stucco construction. On the other hand, of the 28 residences housing low FEP children, 43% were painted houses and 57% were of brick or stucco construction. In general the unpainted residences had lead levels that were about half the level of homes with painted siding. Nevertheless, brick and stucco homes also had elevated, albeit, lower levels of lead in the soils around them. Thus, we sought information on another source of lead which might explain the lead levels around brick and stucco homes.

The right-of-way samples taken at various locations in the city and along streets passing through the neighborhoods contain lead that is most probably from various forms of organic lead compounds that have been used as octane extenders in gasoline. The relationship between traffic volume and lead level of roadside dust and soil is well known (Lau and Wong, 1982). There is also evidence that lead aerosols collect on the sides of buildings and are washed down into the soils during rains (Rolfe and Haney, 1975). This mechanism provides the link between traffic and elevated lead levels which we observe around stucco and brick buildings in the inner city of Minneapolis. In the State of Minnesota during 1982 (excluding 0.16 billion gallons farm use), 1.74 billion (10^9) gallons of gasoline were

TABLE 6
SOIL LEAD LEVELS (μg/g) OF RESIDENCES OF HMONG CHILDREN LIVING IN PAINTED HOMES AND BRICK OR STUCCO HOUSES

	Painted residences		Brick and stucco residences	
Percentile	Lead cases (16)	Low FEP (12)	Lead cases (5)	Low FEP (16)
Lowest	530	475	275	130
25	773	737	410	384
50	938	958	450	554
75	1205	1250	580	1135
Highest	6150	1410	955	1840

consumed for motor vehicle use (Jeffrey Johnson, Minnesota Department of Energy, personal communication). Federal standards allowed refiners, regardless of grade of gasoline, to add an average of 0.50 g (i.e., 500,000 μg) per gallon of gasoline. It is reasonable to assume that refiners put the maximum amount of lead in gasoline. Thus, we find that in Minnesota, 871 metric tons of lead were consumed in gasoline during 1982. Hennepin County at 5.9%, had the highest percentage of vehicle miles traveled in the state (James W. Johnson, Minnesota Department of Transportation, personal communication). The portion of lead emitted in Hennepin County is around 51.4 metric tons. Most of the travel in the county is concentrated toward the center of the city of Minneapolis, that is, next to and within the neighborhoods which the Hmong people inhabit.

New lead standards were established on November 1, 1982. These standards allow refiners to put 1.10 g (1,100,000 μg) lead per gallon of leaded gasoline (Federal Register, October 29, 1982, p. 49322–36). In 1982, 57% of the gasoline consumed in Minnesota was leaded (Jeffrey Johnson, MN DOE, personal communication). Assuming the same level of consumption as 1982, the lead use in gasoline (excluding farm use) for 1983 will be increased by about 16.7% or to 1016 metric tons of lead. The portion emitted in Hennepin County will increase from 51.4 to almost 60 metric tons of lead. Assuming no tampering by automobile owners, as new cars replace older vehicles, lead consumption will be reduced over the next decade (Oil and Gas Journal, 1982). This fact, however, will not help the plight of the present generation of Hmong children who have suffered from elevated blood lead levels. Nationwide, most inner-city air exceeds the EPA's recommended maximum permissible lead level of 1500 ng/m^3 (Settle and Patterson, 1980). In the Twin Cities, water runoff within urban sewers exceeds established lead guidelines at least 90% of the time (Oberts, 1982). There is evidence, as shown in Fig. 2, that recent reductions in leaded gasoline and lead aerosols have been directly responsible ($P = 0.0001$) for the reduction of blood lead levels during the past few years (Annest *et al.*, 1982). Thus, for 1983, with projected increases in lead aerosols, the inner-city lead problem in Minneapolis will worsen.

The presence of high concentrations of surface soil lead in inner-city areas presents an obvious risk to young children living in these areas. Studies conducted over the past decade establish soil and dust as potential sources of considerable significance for the ingestion of poisonous levels of lead (Sayre, 1981). The NHANES II data indicate that 11.6% of central city children ages 6 months to 5 years in population centers of one million or more have blood lead levels greater than or equal to 30 μ/dl (Mahaffey, 1983). This compares with 2.1% of rural children having the same level of blood lead. Many cases are undiagnosed, and even among those where diagnosis of elevated lead has been done, in less than half of the cases has a clear source of lead exposure been identified (Air Quality Criteria for Lead, 1977). Complex variables are involved which make it extremely difficult to sift out clear causal links, but given the established concentration of lead poisoning cases within inner cities it seems only reasonable to suggest that soil lead is a contributing factor (Mielke *et al.*, 1983). Soil lead is at least as absorbable in the human digestive tract as paint lead (Day, 1979). More than half

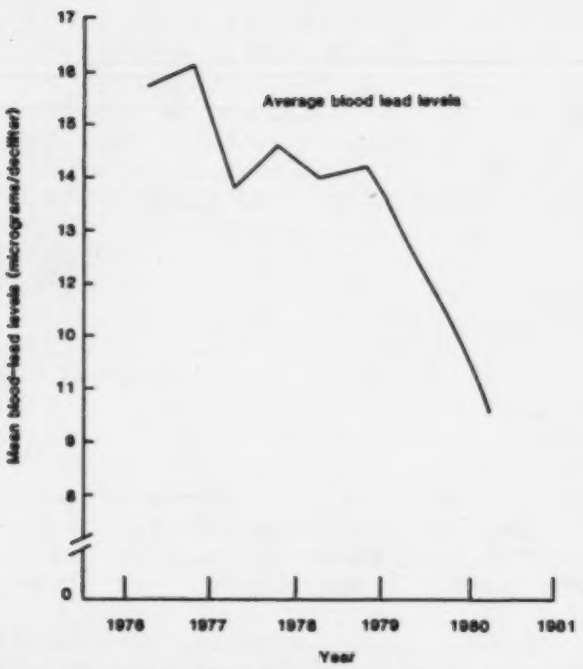


FIG. 2. Mean blood levels of U.S. population 6 months–74 years: United States, February 1976–February 1980. Source: National Center for Health Statistics, 1982.

the Minneapolis inner-city homes of this study have 750 μg/g of soil lead. At a concentration of 750 μg/g, 0.2 g of soil orally ingested would deliver 150 μg of lead. This amount represents the maximum permissible daily intake for children 6 months to 2 years of age (Mahaffey, 1977). Since the lead concentration in finer particles tends to be significantly higher than that of ordinary soil, the lead content of interior or exterior dust likely to be picked up on hands is probably much higher than that reported in our soil sampling (Spittler and Feder, 1979). Previous research has established that the potential lead intake for a 2-year-old child includes 6–60 μg respired and 130–170 μg in food and water (Lepow *et al.*, 1975). Any additional intake from soil lead is intolerable. However, given the inner-city concentrations exhibited in this study, it is also virtually unavoidable if children are permitted to put fingers in their mouths or to mouth articles that are not scrupulously clean. Conspicuous pica activity (as eating soil, per se) may be totally absent and yet the child may still be receiving over 100 μg of lead orally from the faintest traces of dust or dirt.

Elements of chance also may play a significant role in the soil lead danger. Several of the Minneapolis house sites possess a one order of magnitude (i.e., 10-fold) difference in soil lead levels at two separate points in the yard. One sample from Highland Park exhibited a difference of two orders of magnitude (i.e., 100-fold) between the front and back entrance of the home. Behavioral differences among children such as amount of initial hand-to-mouth activity may

result in a cycle of retardation in some children. Exposure to lead may retard the child back into the developmental stage of increased mouthing activity which, in a high lead environment, causes further retardation. An escape from the cycle comes with the maturation of the intestinal tract and subsequent reduction of absorption and retention of lead. But by then serious damage may already have occurred to the central nervous system. The chance choice of play area in the neighborhood would be an issue of considerable importance to the child. Fortunately in Minnesota, children have a reprieve from high lead soils during the 4 months of winter and frozen soils. Thus, depending on chance, the child may be entering and playing in a safe or hazardous environment.

The ultimate lead burden which can be tolerated without serious, permanent neurological damage is a subject of considerable debate. Recent studies suggest the alarming fact that average blood lead levels which presently exist in the U.S. population (Mahaffey *et al.*, 1982) are higher than blood lead levels which are capable of depressing intellectual performance (Yule *et al.*, 1981). Studies in the United States have demonstrated a variety of learning and behavioral deficits in a population of school children (that had not previously been diagnosed with elevated blood levels) which increased with body burden of lead as measured in dentine (Needleman, 1979). The NHANES II study shows that the average U.S. inner-city child has a blood lead level of 20 μg/dl compared with the average rural child blood lead level of 14 μg/dl (Mahaffey *et al.*, 1982). However, British researchers have discovered that a seven-point reduction in IQ is associated with children having blood lead levels of 13 μg/dl and above as compared with those having a blood lead level of 12 μg/dl and lower (Yule *et al.*, 1981). Thus, there is increasing evidence pointing toward lowering the 30 μg/dl standard.

It is widely accepted that duration of exposure is of primary importance in the degree of lead insult to the human organism (Needleman, 1980). American citizens are subject to lead pollution that has contaminated the entire ecological system (Settle and Patterson, 1980). For inner-city children living in an environment where all potential lead sources short of smelting are at a maximum (automobile exhaust, older structures with lead paint, large reservoir of lead in soils, less than ideal diet, etc.), there can be little question that these children face virtually continual exposure to significant amounts of lead throughout their developing years.

In this study one of the critical questions which must be asked is why more children are not developing lead poisoning if the ambient soil lead level near building is so elevated? Several possible answers are suggested which require further research. One possible explanation is that the level of lead poisoning in the community is actually much higher than has been diagnosed. Several of the pediatric clinics serving these neighborhoods (most notably the Indian Health Board) do not routinely use either FEP or blood lead screening so there may exist a considerable number of invisible cases of lead poisoning in the population. The FEP screening may also be less than 100% accurate in indicating the need for blood lead testing (Ellen K. Silbergeld, National Institute of Health, personal communication). Blood lead work is not being done on any patients unless they exhibit an FEP equal to or greater than 50, and normal ferritin, but approximately

50% of the southeast Asians have slightly elevated FEPs above 35 but less than 50. Finally, there may well be a metabolic and or nutritional component involved, at least to the extent of differentiating the Hmong from other groups (Mahaffey and Michaelson, 1980). Calcium, iron, zinc, phosphorous, and possibly other minerals can to some extent diminish lead absorption if supplied in ample amounts. The Hmong may be deficient in one or more of these nutrients. Excessive fat and copper intake appears to increase susceptibility to lead poisoning so these dietary components could also be involved.

CONCLUSION

In this environmental study involving the Hmong children of Minneapolis, we learned much about our society and little about the Hmong culture. The Hmong people are an invited group of newcomers to our society. They live in the oldest housing, most of which was coated with leaded paint. They live at the junction of major highways and roads of the city which are traveled daily by tens of thousands of vehicles consuming leaded gasoline. Because of these activities, the outdoor environments of this community are contaminated with lead levels known to be hazardous to children. Furthermore, being poor people, the Hmong children are prone to nutritional deficiencies; this exacerbates the effect of lead. These facts alone are sufficient to explain the lead poisoning observed in the Hmong children. From an environmental perspective, given the lead levels found in this study, the inner-city urban environment which our society has provided the Hmong, is not presently suitable for raising young children.

The inner city of Minneapolis has the degree of lead accumulation necessary to cause the same epidemic upon our children as has been identified in lead screening programs in other major cities of the nation (Mahaffey *et al.*, 1982). The prerequisite to solving the lead problem is preventing lead exposure. At the heart of the urban lead problem is the issue of the preservation of the principal resource of our civilization, the human mind. The learning ability of children is known to be affected at lead levels far lower than have been measured in the Hmong children of the inner city of Minneapolis. Because lead depresses high level mental functions the social costs of raising children in lead hazardous environments are extraordinarily high. If we value our urban existence and have hopes for the intellectual and cultural achievements of future generations, then we must take the necessary steps to assure that the current population of young children are not raised in an environment containing hazardous levels of lead.

ACKNOWLEDGMENTS

This research was made possible as a result of a gift of an atomic absorption spectrometer and laboratory from an anonymous donor in Boston and the generous contributions of a challenge grant by Mrs. Alida Dayton that was matched by Mr. Richardson Oakie, former Governor Elmer L. Andersen and Mr. Tony Andersen. These contributions plus a Bush grant provided funds for research assistance that was so ably performed by Bruce Blake in carrying out this project. We thank Dr. Amos Deinard of the University of Minnesota, Dr. Karl Chun of Hennepin County Medical Center, and Mr. Gerald Takumi of the Minneapolis Public Health Department for their assistance and cooperation in providing data on the Hmong children. Bush grant student research opportunities made it possible for Nancy Hassinger and Sarah Burroughs to work on the project. Many students were

involved in this research, but the contributions of Kevin Koska and Handy Wade deserve special mention. Finally, we acknowledge the helpful comments of Dr. M. Gordon Wolman and Dr. Ellen K. Silbergeld who reviewed an early draft of this paper. The senior author (H.M.) assumes responsibility for the content and errors of this manuscript.

REFERENCES

Air Quality Criteria for Lead. (1977). Pub. 600/8-77-017. Environmental Protection Agency, Washington, D.C. Chap. 12, p. 36.

Annest, J. L., Mahaffey, K. R., Cox, D. H., and Roberts, J. (May 12, 1982). Blood lead levels for persons 6 months–74 years of age: United States, 1976-80. Advance Data from Vital and Health Statistics, No. 79. DHHS Pub. No. (PHS) 82–1250. Public Health Service, Hyattsville, Md., May 12, 1982.

Day, J. P., Fergusson, J. E., and Chee, T. M. (1979). Solubility and potential toxicity of lead in urban street dust. *Bull. Environ. Contam. Toxicol.* 23, 497–502.

Hammond, P. B. (1982). Metabolism of lead. *In* "Lead Absorption in Children" (J. J. Chisolm, and D. M. O'Hara, Eds.), pp. 11–20. Urban and Schwarzenberg, Baltimore, Md.

Lau, W. M., and Wong, H. M. (1982). An ecological survey of lead contents in roadside dusts and soils in Hong Kong. *Environ. Res.* 28, 39–54.

Lepow, M. S., Bruckman, L., Gillette, M., Markowitz, S., Robino, R., and Kapish, J. (1975). Investigations into sources of lead in the environment of urban children. *Environ. Res.* 10, 415–426.

Mahaffey, K. R. (1977). Relation between quantities of lead ingested and health effects of lead in humans. *Pediatrics N.Y.* 59, 448–456.

Mahaffey, K. R., Annest, J. L., Roberts, J., and Murphy, R. S. (1982). National estimates of blood lead levels: United States, 1976–1980. *N. Engl. J. Med.* 307, 573–579.

Mahaffey, K. R., and Michalson, I. A. (1980). The interaction between lead and nutrition. *In* "Low Level Lead Exposure: The Clinical Imlications of Current Research" (H. L. Needleman, Ed.), pp. 159–200. Raven Press, New York.

Mielke, H. W., Anderson, J. C., Berry, K. J., Mielke, P. W., Chaney, R. L., and Leech, M. (1983). Lead concentrations in inner city soils as a factor in the child lead problem. *Amer. J. Public Health* 73, 1366–1369.

Needleman, H. L. (Ed.) (1980). "Low Level Lead Exposure: The Clinical Implications of Current Research." Raven Press, New York.

Needleman, H. L., Gunnoe, C., Leviton, A., Reed, R., Peresie, H., Maher, C., and Barret, P. (1979). Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *N. Engl. J. Med.* 300, 689–695.

Oberts, G. L., Brown, R. G., and Ayers, M. A. (1982). Water resources management: Nonpoint source pollution technical report. Metropolitan Council of the Twin Cities Area. Pub. No. 10-82-016.

Oil and Gas Journal. (Nov. 1, 1982). Final rules will trim lead in gasoline, pp. 40, 41.

Ratcliffe, J. M. (1981). "Lead in Man and the Environment". Wiley, New York.

Rolfe, G. L., and Haney, A. (1975). An ecosystem analysis of environmental contamination by lead. Institute for Environmental Studies Report No. 1. University of Illinois at Urbana–Champaign.

Sayer, J. W. (1981). Dust lead contribution to lead in children. *In* "Environmental Lead" (R. Lynam, L. G. Piantanide, and J. F. Cole, Eds.), pp. 23–40. Academic Press, New York.

Settle, D. M., and Patterson, C. C. (1980). Lead in Albacore: Guide to lead pollution in Americans. *Science* 207, 1167–1176.

Spittler, T. M., and Feder, W. A. (1979). A study of soil contamination and plant uptake in Boston's urban gardens. *Commun. Soil. Sci. Plant Anal.* 10, 1195–1210.

Yule, W., Lansdown, R., Millar, I. B., and Urbanowicz, M. (1981). The relationship between blood lead concentrations, intelligence and attainment in a school population: A pilot study. *Develop. Med. Child. Neurol.* 23, 567–576.

Natural Resources Defense Council, Inc.

122 EAST 42ND STREET
NEW YORK, N.Y. 10168
212 949-0049

Washington Office
1725 I STREET, N.W.
SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

Western Office
25 KEARNY STREET
SAN FRANCISCO, CALIF. 94108
415 421-6561

TESTIMONY

OF

ERIC A. GOLDSTEIN,

SENIOR STAFF ATTORNEY,

NATURAL RESOURCES DEFENSE COUNCIL, INC.

before the

UNITED STATES SENATE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

concerning

S.2609

and

PROPOSALS TO REDUCE

THE AMOUNT OF LEAD IN GASOLINE

June 22, 1984

New England Office: 16 PRESCOTT STREET • WELLESLEY HILLS, MA. 02181 • 617 237-0472
Public Lands Institute: 1720 RACE STREET • DENVER, CO. 80206 • 303 377-9740

100% Recycled Paper

My name is Eric A. Goldstein and I am a senior staff attorney with the Natural Resources Defense Council, Inc. (NRDC) in New York. NRDC is a national, non-profit legal and scientific organization with over 40,000 members and contributors, which has been active for over a decade on public health and environmental issues including toxic airborne lead. I appreciate the opportunity to testify here this morning and commend you, Mr. Chairman, for your timely scheduling of this important hearing.

Introduction

NRDC supports the thrust of S.2609 and applauds Senator Durenberger's initiative in placing this issue before the Committee. Establishing a mandatory legislative timetable to eliminate lead in gas is appropriate in view of the delays that have characterized the lead phase-down effort over the years and the threats under the previous EPA Administrator to rescind the program entirely. Regulating levels for toxic lead in gas is a task that has subjected EPA to intense industry pressure and one that warrants direct guidance from Congress.

We believe, however, that in view of the serious public health and environmental problems posed by lead in gasoline and the lengthy period industry has had to prepare for the switch to unleaded fuel, S.2609 should be amended to provide for a phase-out of lead in gasoline by 1986 (with continuing provision for a "lite" lead fuel of 0.1 grams per leaded gallon (gplg) for the small percentage of vehicles still requiring lead as a valve

lubricant). Waiting four more years until 1988 before mandating action by EPA is simply too long a delay.

Meanwhile, as Congressional action moves forward, EPA should act promptly by publishing its long-awaited proposal to eliminate lead in gasoline. The existing situation, in which the Agency has announced its likely actions in the press but not the Federal Register, has caused confusion for all affected parties. The time for formal EPA action has arrived.

Time to Act

Prompt action to remove lead from gasoline makes sense now for several reasons. Lower and lower blood-lead levels are being linked with adverse impacts in children, and airborne lead accounts for roughly 50% of total childhood lead exposures. Leaded gasoline -- and only leaded gas -- contains ethylene dibromide (EDB) and ethylene dichloride (EDC), two potent cancer-causing susbtances that have been found in detectable levels in the air of our nation's cities, with higher readings around gasoline stations and heavily travelled highways. Finally, the use of leaded fuel in vehicles equipped with catalytic converters has created a significant environmental problem in its own right -- major, unanticipated emissions of hydrocarbons, carbon monoxide and nitrogen oxides from mobile sources. It was these concerns that prompted the states of Massachusetts and Illinois, the cities of New York and Chicago, nationally prominent scientists and physicians, and public health and consumer groups

to join with NRDC in March of this year in petitioning EPA to phase-out lead in gasoline by January 1986. (See attachment.) *

The lead phase-down regulations have had a beneficial impact over the years. But they have not reduced harmful emissions either as quickly as had been projected or as swiftly as the situation warrants. Both government and industry have traditionally over-estimated the ability of the phase-down program to reduce lead usage. DuPont, for example, predicted in 1979 that by 1982 leaded gas use would decline to 38% of total consumption; the actual figure was 48%. On different occasions in 1982, EPA estimated that the use of leaded fuel would decline to 36% or 43% of total gasoline consumption in 1983. Preliminary year end figures reveal that actual 1983 leaded gas use was 47%. In 1983, a full decade after EPA first initiated the lead phasedown program, approximately 56,000 tons of lead were used in gasoline.

The Congressional Response

S. 2609 would attack these problems by mandating that no later than January 1, 1988 it would be unlawful to offer leaded gasoline for general use. EPA would be given authority to act sooner or to promulgate rules allowing leaded fuel for limited use, presumably for vehicles needing lead as a valve lubricant.

We support the intent of this legislation, but believe that a four year delay -- until 1988 -- before requiring EPA to act is too long to wait. Why? Because the costs of an additional two

*The attachment referred to has been retained in committee files.

year delay are staggering. Although the Agency's detailed cost-benefit analysis focuses on 1988, we can use that report to approximate the real costs of delaying action beyond 1985. In both 1986 and 1987, we can estimate that retaining the existing lead-in-gas standard will mean an additional 43,000 children each year will exceed the Center for Disease Control's safety threshold of undue lead exposure, requiring follow-up medical attention or treatment. Additionally, the cost to consumers in those two years could exceed $780 million annually from added maintenance expenses and quantifiable environmental and health costs that could be avoided if the low-lead alternative were implemented earlier.

EPA's cost-benefit analysis is extremely well documented and forms a solid basis for Congressional action. Administrator Ruckelshaus has stated that with it the Agency has built "a very strong case" that the benefits of banning lead outweigh the economic costs. And Chris DeMuth, former administrator for regulator affairs at the Office of Management and Budget and a frequent critic of EPA regulatory initiatives, called the study "a model of how regulatory issues in the health area ought to be approached."

In fact, on the basis of this report and additional evidence on health and environmental costs of delay, public debate on the timing of a lead-in-gas phase-out has shifted to a faster track. Even segments of industry seem willing to go along with some tightening of the lead-in-gas rules in 1986. As far as we

can tell, many refiners feel they could live with a 0.5 gplg standard in 1986, going down to 0.1 gplg standard by 1988. We believe that there are strong public policy reasons for going to 0.1 gplg in 1986 and that if industry is unable to meet that standard in that year, it is obligated to prove that case in public. This, so far, they have not attempted to do. And even after they have placed this evidence on the record, the Administrator is required to balance the very strong, if unquantifiable, medical impacts, and interpret his Clean Air Act mandate in a way that errs on the side of caution and public health protection.

Phase Out in 1986 Is Technologically Feasible

With respect to a lead phase-out by 1986, we can expect industry to assert that the date is too soon and more time is needed. At this point in the debate, such unsubstantiated claims hold little sway. First, the gasoline refiners have now been on notice for over a decade of government plans to phase out lead from gasoline. The first lead-free and low-lead gas rules were adopted in 1973. Second, some gasoline marketers have indicated that they could meet a 0.1 gplg standard by January 1, 1986. Crown Central Petroleum Corporation, for example, stated, in a letter dated May 16, 1984:

> Because of the misfueling problem, significant domestic refining octane enhancement capacity, which was constructed at the urging of the EPA based on EPA forecasts, is not being fully utilized. Adoption of a 0.1 gm/gal. lead rule would

> allow these facilities to operate more fully where, hopefully, the owners would have a better opportunity to recover the investments which have been made.
>
> Therefore, we support the adoption of a single 0.1 gram standard at the earliest practical time, not more than 12 to 18 months from this date.

Why should we leave open the possibility of another four year subsidy for segments of the industry which, unlike Crown Central, have continued to rely for their profits on government dawdling in phasing out of toxic lead?

Here are three ways in which the industry could rapidly meet a final phase-out of lead in gasoline:

(1) Make full use of existing refining capacity:

According to September 1983 figures from the U.S. Department of Energy, refineries are now operating at only 78% of capacity. This leaves 22% spare octane capacity to raise octane levels without lead. Additional refining capacity could also be made available by reopening shut down refineries (not counted in the DOE figures) and by reduced marketing of very high octane super-premium unleaded grades (again, using freed-up capacity to produce additional unleaded fuel).

(2) Construct additional reforming capacity:

Refinery expansion, much of which is already under construction or being planned, could provide another means to satisfy low-lead gasoline demand by 1986. Swift action by EPA in establishing a 1986 deadline would give refineries 18 months to complete this work.

(3) Increase use of alternative octane enhancers:

A variety of options are available to refiners, including alcohol based fuels, to help meet a 1986 deadline. Excess capacity in oxygenated compounds, for example, is now at over 1 billion gallons in North America alone, an amount equivalent to approximately 12½ of present demand for octane enhancement.

Additional supplies of alternative enhancers would also be available from overseas.

To be sure, obtaining lead substitutes will involve some investments. But the real cost of a 1986 lead phase-out would only be the incremental expense of constructing capital facilities or making other arrangements several years earlier than otherwise anticipated. The industry has long known that the market for leaded fuel would wither by the end of the decade.

Still, we are apt to hear today from industry representatives that a 1986 phase-out is simply impossible to achieve. This is apparently what some companies have told EPA in numerous closed door meetings over the last several months. But they have not yet put their evidence into the record. When I last inquired at EPA, there was no docket established or summary of those meetings available. If industry has legitimate concerns about meeting a 0.1 gplg standard by January 1986, let them put their case before the public, and let them prove it.

Unfortunately, the course EPA has followed in attempting to initiate this final phase-down regulatory review has not been particularly helpful. To be sure, Administrator Ruckelshaus deserves credit for announcing his intent to eliminate lead from gasoline. And his dedicated staff merits praise for preparing a first rate economic analysis. But by continuing to discuss this issue in the press without publishing a formal proposal in the Federal Register, EPA has muddied the waters. This is regulation

by trial balloon, with the result that neither industry nor the public has a clear sense of the rules of the game.

Let me add a final word about the impacts of a lead phase-out on motorists. Both S.2609 and the EPA proposals now being discussed would protect vehicles that require lead for valve lubrication. The percentage of vehicles at risk in this category is small (13.5% of the nation's motor vehicle fleet) and shrinking every day. There is widespread agreement that 0.10 grams per leaded gallon would satisfy the lubrication needs. Indeed, there is evidence that half that much lead might suffice. Since 1971, automobiles have been manufactured with hardened valve seats that obviate the need for a lead lubricant altogether. Whatever regulation ultimately emerges should make available a "lite" lead grade for vehicles at risk from valve recession. The regulations should also establish a date certain for the elimination of all lead from gasoline, taking into account the residual need for leaded fuel as a lubricant for this declining portion of the vehicle fleet. And let us not forget that motorists will realize substantial maintenance savings, projected by EPA at 3 to 4 cents a gallon, from driving with unleaded fuel. The savings will result from reduced need for tune-ups, oil changes, exhaust system replacements and from improved fuel economy.

STATEMEMENT

of

ETHYL CORPORATION

Before

THE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

of the

U.S. SENATE

IN OPPOSITION TO S. 2609

June 22, 1984

37-670 O - 84 - 10

I am Lawrence E. Blanchard, Jr., Vice Chairman of Ethyl Corporation, Richmond, Virginia. With me today is Mr. C. A. Hall, Assistant Director of Air Conservation.

I have been the principal spokesman for Ethyl Corporation for the past 14 years in its defense of the use of tetraethyl lead in gasoline. I am very proud of this product, which was invented by Ethyl 60 years ago and has been included on most lists of the 50 greatest inventions in the history of America. Over those years, it has saved billions of dollars and conserved billions of barrels of crude oil.

Therefore, we strongly oppose the provisions of S. 2609 that ban "leaded gasoline for general use as a fuel for any highway motor vehicle."

We think you have to go back a few years to put this issue in perspective.

On January 14, 1970, Mr. Edward Cole, then president of General Motors, made a speech to automotive engineers in Detroit in which he announced GM's decision to introduce catalytic converters on cars in two or three years, and that this action would require the availability of lead-free gasoline at that time. While Mr. Cole never used that phrase, papers across the country the next day reported the speech under the headline, "'Get The Lead Out,' Says General Motors President."

Even I have to admit it was a clever headline, and it captured the attention of the news media, politicians and environmentalists. After all, even if we couldn't solve all the complex problems, here was one that certainly sounded simple.

I testified on the gasoline lead issue before the Senate Subcommittee on Air and Water Pollution of the Committee on Public Works

on March 25, 1970. In preparation for this appearance today, I reviewed my testimony at that time and, at the beginning, I pointed out:

> "Today we are in the middle of a great emotional furor over lead antiknocks in gasoline. After living through the last six weeks, there is no doubt in my mind that lead has been picked by some as the scapegoat for a host of serious problems."

Today, I feel that way all over again.

The hearings and debates on this and other environmental issues continued throughout 1970, culminating in the passage of the original Clean Air Act. By the time the Act was passed, Congress and all the country had been subjected to a national debate on lead in gasoline, and nearly everyone had learned that the issue was infinitely more complex than had originally been thought at the time of the "Get The Lead Out" slogan. The solution agreed on in the Clean Air Act was to delegate to the Administrator of the Environmental Protection Agency (EPA), which had been created by President Nixon during the course of the debates in 1970, the right to regulate fuel additives (essentially lead antiknock compounds) within carefully worded parameters.

And, that is what has happened for the past 14 years. The EPA has proceeded to regulate lead with ever-increasing severity with the avowed purpose of ultimately eliminating it. However, they too have learned that it is a complex issue, and that many trade-offs are involved. As Mr. Ruckelshaus pointed out in 1972, the first time he was Administrator of the EPA, the regulation of lead in gasoline "is one of the most complicated problems that I have had to face since coming to this job." And he summed up the problem clearly in a television interview on April 1, 1972, when he pointed out:

> ". . . If you don't use lead, you're going to use something else, and if you use aromatics, which are generally considered as the best potential substitute, we can't know what they do to the public health. We do know, on some studies, that aromatics contribute to the problem of smog. Lead does not contribute to that problem, so it isn't just a simple question of let's get the lead out and protect the air. If you get the lead out, you've got to know what the substitute for lead as an additive is going to do. This is the kind of environmental trade-off, and the environmental analysis that has to be done if the community's going to act wisely."

As almost everyone knows today, lead additives for gasoline have several important advantages. In the first place, they increase the octane of gasoline. For this reason, they have saved countless billions of dollars for the American public during the 60 years since they were invented by my corporation.

Secondly, and really a part of the first point, is the fact that they conserve large quantities of crude oil. It is generally conceded that lead additives save about 10% of the crude oil that goes to make leaded gasoline.

And finally lead antiknocks minimize the use of undesirable aromatic hydrocarbons in gasoline.

The objections by the environmentalists usually start with the old saying that lead was the cause of the fall of the Roman Empire and go on from there to assorted claims of adverse health effects. It has long been known that lead in large doses is indeed a serious poison, and the long-neglected problem of ghetto children eating peeling leaded paint is a national scandal. Starting with that, there have been suggestions for at least 25 years that small quantities of lead in the general atmosphere might also have harmful effects, and this aspect has probably been the most widely studied phenomenon in the environment.

We at Ethyl have been leaders in lead-additive research for many years, and it has been our consistent position that, even though lead has been used in gasoline for 60 years, not a single person has ever been discovered to have any harmful effects from lead from automobiles in the general atmosphere.

The most recent activity that has resurrected the lead issue was an indication by the EPA that they were considering further reductions in the amount of lead permitted in gasoline and the possibility of its ban in the late 1980s. EPA has indicated that they will make a public proposal in the near future and hold public hearings. In view of the decision by this Committee and by Congress 14 years ago to delegate this complex subject to the EPA, this hardly seems the time for Congress to take or suggest precipitant action, certainly not without holding many, many more lengthy hearings on the facts than can possibly be done in a few days.

The "Findings" cited in the proposed bill as justification for the proposed ban, are either incorrect or are not relevant to the issue. For example, the statement that lead is known to damage the kidneys, liver, reproductive system, etc., may be true at very, very high levels of lead exposures, but it is not true and is not relevant for exposures from vehicle lead emissions.

Another example is the statement citing effects on intelligence, speech impairment, and academic achievement at low blood-lead levels which is also incorrect. The EPA "Expert Committee on Pediatric Neurobehavioral Evaluations" has recently concluded that "The Committee knows of no studies that, to date, have validly established (after proper control for confounding variables) a relationship between low-

level Pb exposure and neuropsychologic deficits in children."

Despite continuing differences on some of the lead issues, a few facts are clear:

(1) When lead is removed from gasoline the octane numbers it provided must be replaced. This is generally accomplished by additional refinery processing which requires additional crude oil. Because of this, we have contended since the beginning of this debate in 1970 that removing lead from gasoline would increase its cost to the public by 5 to 10 cents a gallon. The present differentials between leaded and unleaded regular at the pump are generally in that range, but many older cars would require unleaded premium and that differential is clearly more than 10 cents.

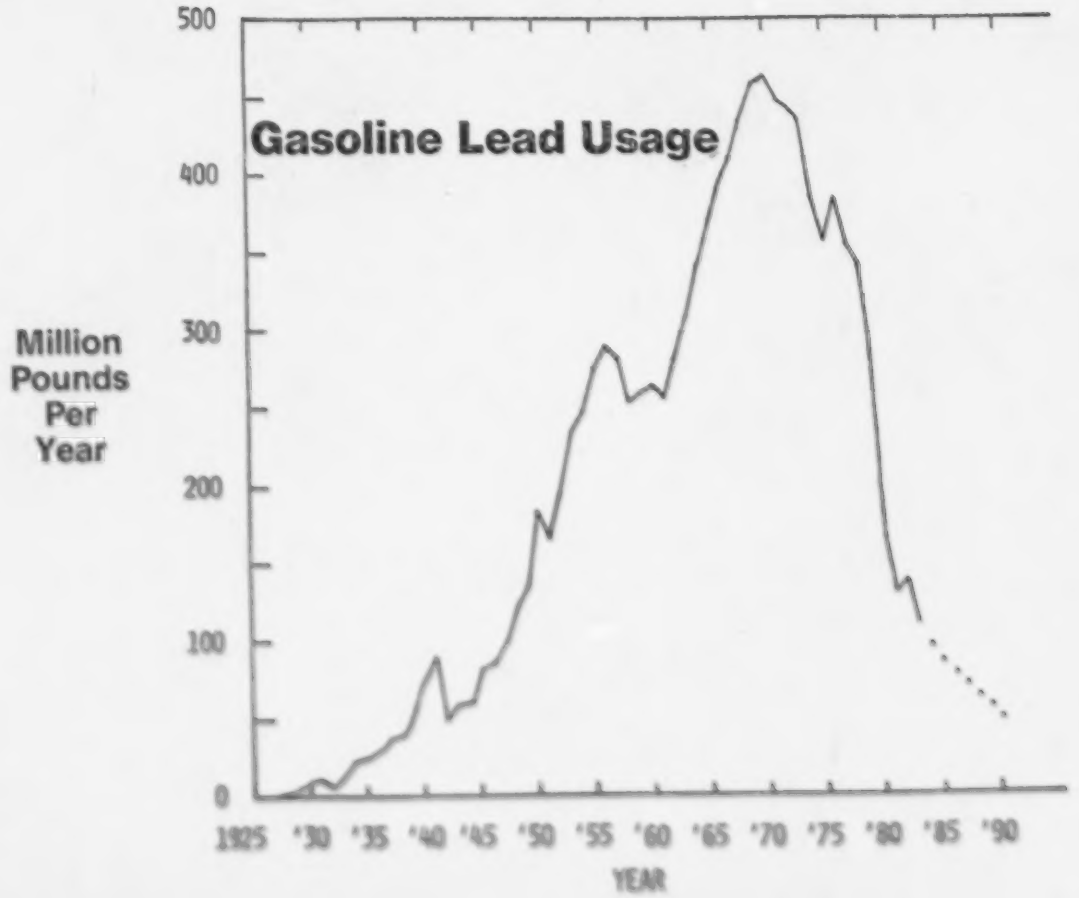
Banning the use of lead antiknocks would have the same effect as putting an additional 5 to 10 cents a gallon tax on gasoline but only to be paid by the people who cannot afford to own a car built after 1975. I cannot believe that this is a sound approach to the solution of any alleged problem. Imposing a 5-cent-a-gallon tax on everyone two years ago was a significant tax increase, but imposing an additional charge of 5 to 10 cents a gallon only on the owners of older cars is unreasonable regressive regulation.

(2) There are still almost 50 million cars and trucks on the road that were designed to operate with leaded gasoline, and even by 1988 there will still be more than 25 million such vehicles. In addition, there are millions of

of marine and other off-highway equipment engines that require leaded gasoline. Primarily because of the design of the exhaust valve seats in those engines, the use of unleaded gasoline over any significant period of time will cause severe wear problems. With exhaust valve seat wear, fuel economy troubles and hydrocarbon emissions increase many-fold. Once severe wear has occurred, the replacement of cylinder heads at a cost of at least $500 is the only alternative. General Motors has previously testified that "many vehicles on the road today require lead to avoid catastrophic engine failure."

(3) The attached graph shows gasoline lead usage in the U.S. from the period 1924 to present, with projections through 1990. The decrease in usage since 1970 is quite dramatic. The usage is now less than it was in 1948 and is decreasing very rapidly. To the extent the usage continues to decrease with the disappearance of the older vehicles, the problems described above will not exist. To the extent this natural phaseout is replaced with a total ban, cost increases and serious problems will result for the owners of a very large number of older cars, trucks, boats and other gasoline engine equipment

We submit that an abrupt interruption of the present rate of decrease with a precipitant ban is not sound--politically, socially, or enviromentally.


Gasoline Lead Usage
Million Pounds Per Year
500
400
300
200
100
0
1925
'30
'35
'40
'45
'50
'55
'60
'65
'70
'75
'80
'85
'90
YEAR

STATEMENT

Of

RICHARD H. LINCOLN

MEMBER, BOARD OF DIRECTORS

NATIONAL MARINE MANUFACTURERS ASSOCIATION

Before the

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

Of the

UNITED STATES SENATE

IN OPPOSITION TO S. 2609

June 22, 1984

Mr. Chairman and Members of the Committee:

I am Richard H. Lincoln, Director of Environmental Affairs for the Outboard Marine Corporation of Waukegan, Illinois. I appear today in my capacity as a member of the Board of Directors of the National Marine Manufacturers Association, the nationwide trade association of the recreational boating industry. On behalf of NMMA's more than 800 member companies, I want to express our thanks for the opportunity to testify on S. 2609.

Introduction

In the ongoing national debate over the reduction or elimination of lead from gasoline, the industry that NMMA represents appears to have been largely overlooked. For that reason, the Committee's invitation to appear today is especially welcome. The recreational boating industry is a significant factor in the American economy: according to the latest NMMA estimates, last year American consumers spent approximately $9,375,000,000 for new and used boats, motors and engines, accessories, fuel, repairs and other incidentals related to the nation's top family sport. NMMA estimates that there were 9,051,000 outboard engines in use in 1983 throughout the United States, as well as an additional 1,517,000 inboard and inboard/outboard-drive engines during the same period.

One of the purposes of my testimony today is to explain why lead is, and will for the foreseeable future remain, a necessary fuel additive for a large segment of the marine engine population. But the initial point that needs to be emphasized,

in my view, is that the recreational boating industry is an important part of American life, and should be recognized as such in planning and policy-setting activities. While Congress and the Environmental Protection Agency are correct to focus much of their scrutiny on automobiles and light-duty trucks -- our principal transportation vehicles for everyday living and much of our commerce -- what we do with our leisure time, such as boating, should not be ignored.

The recreational boating industry is keenly aware of the national health concerns that S. 2609 seeks to address. We are not opposed to a reasonable phasedown of lead levels in the American gasoline pool, but we cannot support the ban proposed by S. 2609. This legislation is unnecessary. EPA already has the statutory authority, the administrative expertise, and a rulemaking program well underway to reduce the permissible limits of lead in gasoline. Moreover, the solution proposed by the bill -- a general ban on leaded fuel for automobiles -- will create more problems than it resolves.

Having stated our position, let me explain how the recreational boating industry has come to adopt it. It is a matter of economics, engineering, and safety.

A Ban on Leaded Automobile Gas Would Drive the Fuel Out of the Marketplace

If S. 2609 were enacted, its practical effect would be to eliminate leaded gasoline from the market for <u>any</u> purposes. We recognize that S. 2609 by its terms proposes to ban only

leaded gasoline "for general use as a fuel for any highway motor vehicle." The bill goes on to provide that EPA may, by regulation, continue to authorize the sale of leaded gasoline for limited purposes. While this proposed legislation seeks to recognize the need for lead in gasoline for special-purpose applications, we believe that it will simply promote the disappearance of leaded gasoline. Should a ban on leaded gasoline for automobiles be instituted by 1988 -- or any other subsequent date, for that matter -- the market for special-purpose leaded gasoline would soon become zero.

The recreational marine industry accounts for less than one percent of total gasoline consumption. In its draft cost/benefit study, the EPA estimates that the whole of "special" uses, which includes heavy-duty trucks and agricultural equipment, amounts to 9.6 percent of total gasoline demand.1/ This slim market fraction will not, in our judgment, support a product line of leaded gas once an automotive ban takes effect. We believe it more likely that refiners will discontinue offering leaded gasoline for sale at reasonable prices once the process plants convert to the production of no-lead products for automobiles.

1/ Office of Policy Analysis, USEPA, Final Draft Report, "Costs and Benefits of Reducing Lead in Gasoline" (Mar. 1984) at IV.47 (hereinafter "EPA Cost/Benefit Study").

EPA appears to recognize this prospect and suggests that, under either a no-lead or low-lead regime for automobiles, "marketing strageties" may play a role in fixing the selling price of leaded gasoline.2/ That assumption is clearly right, but does not go far enough. Moreover, it is important to recognize that no separate distribution system exists for marine gasoline. NMMA estimates that 85 percent of the fuel used for outboard and stern-drive powered boats is bought at automotive gas stations.

Many Marine Engines Require Lead for Adequate Performance, Lubrication, and to Prevent Excessive Valve Wear

From an engineering standpoint, we are concerned that the likely unavailability of leaded fuel in the future will exact a severe toll on marine engines in terms of performance and life. Significant operational demands are placed on marine engines by their operators. Generally speaking, marine engines are designed for heavy duty cycles and load factors, and for sustained, reliable service over a long lifetime. Marine engines typically operate at high RPM's; some users select wide-open-throttle settings for routine operation. Given these operational patterns, one should not attempt to extrapolate control technologies for marine engines from facts known about light-duty automotive engines.

2/ EPA Cost/Benefit Study at I.7. See also id. at II.14.

As you know, putting lead in gasoline has been the cheapest and most effective means to enhance the octane rating of the fuel. With smaller outboard engines -- which can be roughly grouped as those below 50 horsepower -- lead-free gasoline poses few problems. For outboard engines in the 50-125 horsepower range, leaded gasoline is frequently the preferred fuel, although lead-free gasoline can often be used without adverse consequences. For outboard engines larger than 125 horsepower, an important and fast-increasing segment of the outboard population, leaded gasoline is a necessity for many designs. The same is true for the vast majority of inboard and inboard/outboard-drive engines.

The need for lead as a fuel additive is common to both outboard and inboard motors for two reasons. First, lead additives are octane enhancers. Octane performance of a fuel relates directly to the ability of an engine to utilize the energy contained in each unit of fuel. If an engine designed for a high-octane fuel is operated with a low-octane product, catastrophic phenomena, such as knock, will occur. Knock causes extremely high temperatures within the cylinder, resulting in damage or destruction of the piston, piston rings, bearings and other parts.

Second, leaded fuel provides exceptionally good lubrication of engine components subjected to high temperatures and loads. While certain other additives may increase the octane rating of gasoline, we know of no additive that exhibits

comparable lubricating qualities to those of lead. These two characteristics of lead, boosting octane and improving lubrication, are desirable and often necessary both for outboard engines (most of which are of the two-stroke design) and for inboard engines.

Inboard and inboard/outboard engines (which are typically four-stroke designs of four, six or eight cylinders) require lead for an additional reason: to prevent excessive exhaust-valve recession. It is now well known that valve recession, a process of undue wear and deterioration of the valve, occurs when four-stroke engines are operated at high temperatures, loads, or engine speeds, thereby creating both abrasion and adhesion on the valve seat. Tetraethyl lead has long been the remedy of choice for exhaust-valve recession. As lead concentrations in gasoline have dropped during the past ten years or more, the automotive industry has learned that adequate valve life can be secured in low-lead environments through the use of new materials and metallurgical techniques. This solution is also available to the inboard engine builder, but the stresses imposed by heavy marine duty cycles and loading conditions can result in less durable engines, even with hardened valve seats.

These operational constraints are well understood. We find it dismaying, therefore, that the latest low-lead option being considered as a regulatory strategy by EPA sets permissible lead limits at 0.1 grams per gallon, especially when one of the supporting technical documents used in EPA's cost/benefit study

clearly establishes that 0.5 grams per gallon is required to achieve full suppression of valve wear for engines operating under high-load conditions.3/

Banning lead from marine engine applications would, of course, create more unacceptable results -- chief of which is the real prospect of catastrophic engine failure. While EPA has calculated that some 10.9 million heavy-duty trucks may be exposed to a high risk of severe valve recession in 1988 in the absence of leaded gasoline, the agency did not consider similar effects in the marine industry. Indeed, when EPA tabulated the types and numbers of vehicles that would be threatened by a no-lead regime, for boats we find only the entry "not calculated"4/ -- despite the great number of marine engines that would likely be affected in a similar way. We think that a disregard of the consequences of no-lead or extremely low-lead strategies for the marine industry is inappropriate.

Alternative Gasoline Additives May Create Severe Safety Risks

Another consequence of S. 2609, and other strategies that eliminate or drastically curtail the use of lead, is the forced shift to octane enhancers other than tetraethyl lead. Unfortunately, for the marine industry the so-called oxygenates

---

3/ A.E. Felt and R.V. Kerley, "Engines and Effects of Lead-Free Gasoline," SAE Paper No. 710367 (Oct. 1980).

4/ EPA Cost/Benefit Study at III.43.

are, for the most part, unsuitable. Both methanol and, to a lesser degree, ethanol in some concentrations are known to induce corrosion and related problems in fuel pumps, filters, carburetors, and fuel tanks, partly because the substances attract and hold moisture which, in turn, leads to corrosion. In a marine environment where water contamination is an ever-present risk, the tendency of these substances to separate into two layers, a gasoline-rich phase on top and an alcohol-water phase in the bottom, is greatly increased. Such phase separation hastens corrosion of metal parts of the fuel system.

Moreover, these alcohols can attack the plastics and elastomers used in flexible fuel lines and other fuel system commponents aboard marine craft. To minimize vibration fatigue, Coast Guard safety regulations require the use of type-approved flexible fuel hoses on all gasoline-powered boats, except those with outboard engines. The outboard industry similarly employs approved flexible hoses, which are mandated by voluntary performance standards. As alcohol permeates the fuel lines, swelling and elongation first occur, followed by stiffening and cracking of the lines. This, in turn, promotes fuel leakage into engine compartments and bilges. As you will readily appreciate, the presence of free, volatile fuel aboard watercraft creates a serious risk of fire and explosion.

Other techniques to boost the octane rating of lead-free gasoline include blending with benzene and aromatic hydrocarbons.

Although the marine industry does not have extensive experience with these additives, there are indications that benzene may exhibit the same destructive characteristics as alcohols in the presence of flexible fuel lines.

We find scant evidence that any of the alternative octane enhancers offer any improvement in performance over leaded fuel, but it is clear that they can pose serious safety hazards. Through its strong voluntary standards efforts, the recreational boating industry has long been committed to improving boating safety. With more than 9 million powerboats in the domestic fleet -- the vast majority of which are equipped with flexible fuel lines and fuel system components subject to failure -- a large segment of the American public would be potentially subjected to extraordinary risks with alcohol-boosted fuels. The Committee's concerns for improving public health and the environment should not allow the grave public safety risks created by oxygenated fuels to be obscured.

NMMA Proposes a Lead Phasedown to 0.5 Grams per Gallon

While NMMA is not opposed to the notion that leaded automotive fuel be reduced in quantity and concentration in order to achieve desirable national health objectives, some mechanism needs to be developed to ensure the presence of adequate quantities of leaded gasoline for special purposes at realistic prices. The present bill under your consideration will only hasten the rapid obsolescence and destruction of millions of

marine engines, while putting millions of boaters potentially at risk. Such a result, is, we submit, both socially unsound and politically ill-advised.

We believe that a phasedown of maximum permissible lead levels to 0.5 grams per gallon for all gasoline users is a realistic and prudent way to address both health concerns and the need for adequate fuel supplies. With sustained engineering effort, the marine industry could meet this design objective for all outboard and inboard engines by 1990. By doing so, we can simultaneously preserve the performance characteristics and operating life of 10 million existing engines and boats, provide market incentives for the continued production of low-lead fuels, and achieve more than a 50 percent reduction in maximum lead concentrations over current EPA standards.

Setting a national ceiling at 0.5 grams per gallon will also serve to accelerate the shift away from lead, the use of which has been on the decline since the mid-1970's.5/ Not

---

5/ For example, the domestic consumption of refined lead for the manufacture of gasoline additives has clearly trended downward, as this table shows:

(Thousand metric tons)

1976	1977	1978	1979	1980	1981	1982	1983
217.5	211.3	178.3	186.9	127.9	111.4	119.3	(85.0)est.

Source: International Lead and Zinc Study Group, Draft Report, "Lead in Gasoline," LZ/EC.83/7 (Oct. 4, 1983).

surprisingly, the observed concentration of airborne lead has similarly undergone a dramatic decline during the same period.6/ Given the substantial improvement that earlier lead limits have fostered, we can expect at least comparable reduction with a 0.5g/gal. standard.

Selecting appropriate air-quality and fuel standards from a range of alternative regulatory strategies, such as the one proposed here, is the responsibility of the Environmental Protection Agency. We pledge the best efforts of our association and the industry it represents to work with EPA toward finding acceptable solutions to this important problem. A phasedown of lead levels in gasoline can be accomplished without special legislation. S. 2609 does not merit your favorable consideration.

6/ Over the last ten years, the concentration of lead in California's South Coast Air Basin has been reduced by approximately 90 percent. The following table presents maximum 30-day averages of ambient lead levels, expressed in micrograms per cubic meter:

'75	'76	'77	'78	'79	'80	'81	'82	'83
9.39	10.04	6.77	5.48	3.91	3.44	1.91	1.70	1.36

Source: California Air Resources Board.

TESTIMONY

OF THE

HONORABLE BIRCH BAYH

BEFORE THE

SUBCOMMITTEE ON TOXIC SUBSTANCES AND ENVIRONMENTAL OVERSIGHT

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

June 22, 1984

Thank you Mr. Chairman. It is a pleasure for me to come before this Committee today to express my views concerning the proposed legislation to ban the sale of leaded gasoline. Although I am relatively familiar with the public policy issues raised by this important legislation as a result of my past exposure to them as a Senator and the Chairman of the National Alcohol Fuels Commission, I am here today simply in my capacity as a private citizen who is seriously concerned about the adverse effects of lead use in gasoline on human health.

I am well aware that this Committee has heard from many witnesses today who are far more capable than I to speak to the very specific health hazards of lead, and of the unacceptable consequences of allowing its continued use in motor gasoline, where 90% of lead usage in the U.S. occurs. In my own opinion, the overriding need for this legislation from a health perspective should ensure its speedy enactment. However, I am also aware that there are potential roadblocks. There are those who

oppose the passage of the lead-ban primarily because of the requirements which will be imposed if the legislation is enforced in a timely manner, e.g., within the next year or two. The major concern expressed is based upon the belief that without bad additives, the nation will force an octane gap.

Consequently, I would like to focus my brief remarks here this morning on the significant potential that I see for the Congress to tap the excellent octane enhancing qualities of domestically produced fuel ethanol as a means of meeting this "octane gap", and thereby meeting a myriad of other important public policy objectives in the process. While I would be the first to recognize that the use of fuel ethanol as an octane enhancing agent is not a panacea, I believe that the past five years of the industry's development are an eloquent statement of its potential to make significant contributions to the refiners' need for a stable, reasonably priced additive that is environmentally acceptable and has proven performance.

In order to conserve the Committee's time, I would like to look at ethanol's potential as a replacement for lead at the refinery from several general aspects:

• Ethanol has developed over the past five years from virtual non-existence to the most significant liquid fuel alternative in the gasoline marketplace.

• Ethanol has proven compatibility with automobiles engines and its effectiveness as an octane enhancing additive at the refinery.

• Ethanol's production is based upon proven technology, which promises optomistic projections of future increased production levels.

• Ethanol's temporary need for tax preferences, and the returns to the taxpayer as a result of the alcohol fuels program.

A. FUEL ETHANOL INDUSTRY: 1979-1984. There is little need for detailed elaboration of the graphs and charges attached (attachment A) to my testimony as they accurately describe the dramatic growth of the domestic fuel ethanol industry over the past five years. In response to the incentives established by the Congress just a few years ago, private firms and investors have committed over $1 billion to dozens of production facilities that will produce over 500 million gallons of fuel ethanol in 1984, enough to displace over $350 million of imported oil. Fuel ethanol, unlike other liquid fuel alternatives, such as oil shale and tar sands, has the advantage of having realitvely manageable capital requirements, with a proven--although rapidly improving -- technology, relatively short construction lead times, and no

environmental problems. The development and growth of the industry has stemmed from ethanol's evolution as a simple gasoline extender during the gasoline lines of 1979 to today's highly regarded octane enhancer, which blenders utilize to increase the octane level of a given gasoline by an average of of three points with a 10 percent blend of ethanol. This evolution has been characterized by a shift in the label attached to fuel ethanol blends, from the initial "gasohol" to today's "ethanol-enhanced" gasolines.

It should be noted for future reference that there is a synergy with fuel ethanol production between U.S. energy security objectives and its agricultural policy objectives. The fuel ethanol industry has become the fastest growing -- and potentially the most significant -- new market for American grain producers, who desperately lack stable outlets for their efficient production capabilities. This particular aspect of the industry means significant savings to American taxpayers as well,

who have in recent years been shouldered with billions of dollars in payments to farmers to idle acreage and pay for surplus production.

It is now accepted that fuel ethanol from renewable resources is the most significant source of increased liquid fuel and octane supply alternatives in the U.S. in the near term, and that its widespread market acceptance puts it far out in front of other contenders for use in motor fuel blending.

B. ETHANOL'S DEMONSTRATED VALUE AT THE REFINERY. In 1983 alone, American motorists drove roughly 80 billion miles on ethanol-enhanced gasoline blends (the equivalent of over 4 billion gallons of fuel sold). Ethanol has the unique characteristic of being the only alcohol that is accepted by nearly every automaker in its warranty coverage, and has received blanket waiver coverage by the EPA for 10 percent blends or less. In addition, fuel ethanol has matured to the point where it can now

be claimed that it is used successfully directly at the refinery (see attachment B),* as opposed to simply blended at the terminal rack. A host of technical studies conducted by oil companies majors and independents alike, have confirmed ethanol's octane enhancing capabilities, as well as its logistical and handling ease.

Attachment C,* underlines ethanol's comparative performance as octane enhance versus some of the other leading contenders as replacements for lead. As the attachment makes clear, ethanol is a superior product as an octane enhancing agent in nearly every category, including octane blend value and cost per octane barrel (assuming the existence of the current tax incentive).

This committee will undoubtedly want to determine the best way to ameliorate the two major problems associated with a decision to accelerate the phaseout of lead; the perceived anti-competitive impact on refiners that do not have the capital to

* The attachments have been retained in committee files.

make the very expensive equipment additions necessary to upgrade gasoline octane, and the increased loss of crude oil caused by the need to intensify the use of the high severity reformers and other very energy intesive refinery processes. On both counts, it is obvious that ethanol addresses the concerns. With regard to the ability of non-major oil refineries to adapt to lead phaseout successfully, it is clear that an increased supply of ethanol would afford refiners with a very cost competitive material that would enable them to compete with refiners even on an incremental reforming basis.

As far as ethanols' ability to reduce the loss of crude oil due to increased reformer severity, the attached excerpts from a recent Ethyl Corporation analysis of the leading oxygenates makes very clear ethanol's superiority in terms of displacing crude oil. (See Attachment D)* This is due not only to its ability to actually displace oil on a one-to-one basis up to 10 percent of the gasoline volume, but also due to ethanol's excellent octane

*Retained in committee files.

enhancing characteristics. The combination of the two qualities makes ethanol far and away the best octane enhancing additive for the nation in terms of displacing costly oil imports.

C. ETHANOL'S PRODUCTION POTENTIAL. It is my understanding that some industry experts have calculated that the accelerated phaseout of lead could create an octane gap of roughly 30-40 billion gallons of alcohol equivalent over the next eight-year period. Obviously, the immensity of this shortfall puts a premium on those alternatives that are capable of quickly increasing their production levels. As I indicated in the first section, the fuel ethanol industry has demonstrated a remarkable ability to quickly expand its capacity, even in the face of a very uncertain policy environment. The attached graph gives some idea of one industry analyst's projections of the near-term future in terms of additions to ethanol production capacity. (See attachement E)* However, it is clear that a change in the public policy environment established by the Congress that would provide

*Retained in committee files.

a more stable climate conducive to increased private sector commitment could generate a capacity expansion response that far exceeds even these modest projections. Some observers have noted that a very realistic goal would be for the industry to process roughly 10 percent of the nation's corn crop (at full production) into fuel ethanol, which would represent enough ethanol over the next eight year period to meet approximately half of the alcohol equivalent octane gap noted previously (15 to 18 billions gallons).

It should be emphasized that the technology for fuel ethanol production has been advancing dramatically every year, in response to the commercialization potential opportunities offered by the tax incentives. One example of this advance in technology is the attached anaylsis (Attachment F)* from the U.S. Department of Agriculture and Energy which recently laid to rest the early criticism leveled at fuel ethanol by some detractors that it had a negative energy balance. Technologies in the near future will

*Retained in committee files.

include new forms of enzymes and yeasts, improved distillation efficiencies, commercial capabilities to utilize expanded feedstocks like forestry residues and urban wastes, and more efficient crop varieties especially suited for fuel ethanol production. The potential for greatly expanded production levels in the mid to long-term future is substantial and exciting.

D. THE PUBLIC POLICY RATIONALE FOR FUEL ETHANOL INCENTIVES.

As one of the earliest proponents of fuel ethanol industry incentives during my years as a U.S. Senator, I am very familiar with the criticisms most often leveled against fuel ethanol because of the requirements of tax incentives. Without taking the time to mention the long history of all of those emerging industries that have also required substantially larger support (especially including the oil industry, which often now howls the loudest), I believe it would be useful for this Committee to briefly look at some of the recent evidences of fuel ethanol's contributions back to the Treasury, and the overwhelming evi-

dences that the tax expenditures that will be required for the next several years before fuel ethanol is competitive with petroleum-derived octane enhancers will indeed provide a good return on the investment. Because of the unique synergism of the fuel ethanol industry mentioned earlier, it is necessary to recognize the various dimensions of its value to the nation that go beyond merely its energy contributions. They include:

-- The agricultural impact. The attached graph (Attachment G) provides a clear illustration of the importance of the expanding fuel ethanol industry as much as a needed domestic outlet for U.S. agricultural production. Given the disturbing stagnation of farm product exports, the increased value -- added processing of grains into fuel ethanol and its valuable co-products is a critical tool to reduce taxpayer outlays for agricultural commodity programs, particularly the multi-billion dollar payment to farmers not to plant. Historically, a healthy farm economy has stimulated the rest of the economy by its ripple effects; a

recently completed General Accounting Office Analysis (GAO) of the fuel ethanol industry concluded that farm income would increase $3.5 billion annually from a one billion gallon per year ethanol industry.

-- The balance of trade impacts. In addition to the significant benefits to the national economy from the fuel ethanol industry's reduction of costly oil imports (the GAO report found that a one billion gallon per year industry would reduce oil imports by at least 30 million barrels per year), the balance of trade ledger oil imports by at least 30 million barrels per year), the balance of trade ledger would benefit from increased sales of the high protein co-product, which is today in great demand abroad as an excellent high protein supplement for livestock. A recent anaylsis of the U.S. industry by the respected Georgetown University Center for Strategic and International Studies (CSIS) found that the protein exports from a 2 billion gallon per year

industry could result in a net gain of $1 billion per year to the U.S. trade balance.

-- Job creation and economic stimulation. By keeping hard-earned U.S. dollars at home in the local economies, as opposed to sending them to foreign oil producers, the U.S. fuel ethanol industry has served to productively stimulate the economy by creating jobs and generating demand for U.S. equipment and goods. The GAO found that the infant industry has already generated nearly 20,000 new jobs, and that the potential for tens of thousands more was great.

-- Heightened energy security. Finally, as indicated by the CSIS analysis as mentioned above, the U.S. fuel ethanol industry does make a significant, and growing, contribution to the improvement of the nation's liquid fuel security. While it again represents no panacea, the ability of this decentralized liquid fuel source to mitigate the shock of minor oil interruptions is very real,

and the GAO study indicated that the potential for a Strategic Alcohol Fuel Reserve (SAFURE) was also very real for the mid- to long-term.

I would like to conclude my brief remarks with a few general observations about the existing fabric of fuel ethanol tax incentives, and respectfully offer a recommendation for further action. As the attached map (Attachment B)* attests, there are currently 32 states that offer their own fuel tax incentives to complement the federal 5¢ exemptions for fuel ethanol blends. This additional level of incentive is currently necessary for fuel ethanol blends to be competitive with straight gasoline at the pump. Due to the balkanization of these incentives, and the uncertainty associated with their term and levels, the dependence on the state incentives has posed a significant obstacle to the needed orderly expansion of production levels and efficient nationwide marketing of ethanol as a motor fuel octane enhancer. The Congress has recently entertained proposals to end this

*Retained in committee files.

balkanization of the fuel ethanol industry by replacing the present fractured structure with a uniform federal exemption sufficient to stimulate the needed increase in fuel ethanol production by totally eliminating the federal excise tax on fuel ethanol blends. I would strongly urge this Committee to enact such a proposal, which would allow the states to end their exemptions, and pave the way for the desired increase in fuel ethanol use at the refinery as a replacement for lead, along with the other attendant benefits we have briefly noted here.

Finally, I would strongly urge that this Committee consider relieving the Highway Trust Fund of its burden of "financing" the development of the fuel ethanol industry by providing for the Trust Fund's reimbursement by the General Treasury. As the GAO report demonstrated, it is the general taxpayer that benefits most from a vigorous fuel ethanol industry, and it is therefore only reasonable that the General Fund compensate the Trsut Fund for its losses associated with the exemption. I recognize the

complexities involved in assuring that the Budget Act requirements of the Trust Fund user tax contribution levels are met to assume the waiver from the appropriations process*, but there is no question that this change is both justified and achievable.

In conclusion, Mr. Chairman, I commend you for your far-sighted leadership in developing this legislation to end what is a proven threat to the health and mental capabilities of our nation's children. I greatly appreciate this opportunity to submit my views to your Committee concerning the significant contribution that fuel ethanol from renewable resources can make to the elimination of lead from motor gasoline. I would strongly urge that your Committee actively pursue any appropriate means at its disposal -- including those I have briefly cited here -- to achieve the increased production and use of fuel ethanol as an

---

* To be waived from the annual appropriations process requirements, no more than 10 percent of the Fund's monies may come from other than "users fees."

octane enhancing additive in U.S. refineries. The result would provide a healthier environment for all Americans, young and old alike, and make our country economically and militarily stronger. Thank you.

National
Council of
Farmer
Cooperatives

Testimony of

R. Thomas Van Arsdall
NATIONAL COUNCIL OF FARMER COOPERATIVES

Before the

SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

In the matter of

S.2609

"Airborne Lead Reduction Act of 1984"

Friday, June 22, 1984

1800 Massachusetts
Avenue, Northwest
Washington, DC 20036
202/659-1525

Serving America's Family Farmers

Testimony of R. Thomas Van Arsdall
NATIONAL COUNCIL OF FARMER COOPERATIVES

Before the
Senate Environment and Public Works Committee

In the matter of
"Airborne Lead Reduction Act of 1984" (S.2609)

June 22, 1984

Mr. Chairman and Members of the Committee, my name is R. Thomas Van Arsdall, and I am Vice President of Agricultural Inputs and Services with the National Council of Farmer Cooperatives (NCFC). We appreciate the opportunity to testify before you today on a matter which has the potential of working a serious hardship upon one of the country's essential industries in the midst of a protracted period of financial difficulty.

THE NATIONAL COUNCIL OF FARMER COOPERATIVES

The National Council is an association of cooperative businesses which are owned and controlled by farmers. Our membership includes 107 major marketing and farm supply cooperatives, the 37 banks of the cooperative Farm Credit System and 32 state councils of farmer cooperatives. The National Council represents about 90% of the more than 6,100 farmer cooperatives in the nation, with a combined membership of nearly two million farmers.

Among the farmer cooperatives that the National Council represents are supply cooperatives which own and operate five efficient refineries possessing an aggregate production capacity of 301,000 barrels per day, and whose yields of gasoline, diesel fuel and heating oil amount to approximately 85 to 90% of their refined products. Farmer cooperatives market petroleum products in more than 40 states and currently supply about 45 % of all on-farm fuel and a large portion of rural needs.

The cooperative petroleum system represents the only segment of the oil industry in which the consumers of its products are also its owners. This feature carries with it a unique accountability in terms of commitment of supply, service and price.

THE LEAD PROBLEM

Since the mid-1970's, the Environmental Protection Agency has, through enabling legislation passed by the Congress, been working to reduce hydrocarbon emissions from automobiles.

This effort has seen the installation, on recent model automobiles, of various environmental controls, including catalytic converters which oxidize hydrocarbon emissions. The requirement to use unleaded gasoline in such automobiles has

markedly changed the nature of the nation's gasoline pool. The supply of unleaded gasoline has increased from 27.5% of total gasoline supplied in 1977 to 57.5% in the first quarter of 1984.

Attention has also been given to the reduction of lead emissions from motor vehicles that use leaded gasoline, as evidence indicated that negative health impacts were being experienced at lower than previously suspected exposure levels.

Therefore, the allowable level of lead in gasoline intended for use in engines requiring leaded gasoline has been decreasing steadily over the last several years. Currently, the lead level is set at 1.1 grams per leaded gallon.

WHY AN OBVIOUS ANSWER IS NOT THE BEST ANSWER IN THIS CASE

Given the altruistic objective of reducing lead emissions and related environmental problems, the simplest and most obvious answer would seem to be the elimination of leaded gasoline.

However, such an alternative would create havoc within the agricultural community if implemented at this time.

According to a United States Department of Agriculture (USDA) report, a large number of gasoline powered units remain on farms[1]:

> "While virtually all wheel tractors, combines, and many other types of farm equipment manufactured today are diesel powered, a large number of gasoline-powered units are still on farms and will be for many years if leaded fuel is available. There are an estimated 1.7 million gasoline-powered tractors and 308,000 gasoline-powered self-propelled combines now on farms. More than 1 million gasoline-powered tractors and 200,000 gasoline powered combines probably will be used on farms in 1988. In addition, some 110,000 to 165,000 other gasoline-powered machines (such as windrowers, cotton pickers and sprayers) will be operated on farms in 1988."

Lead is required in most of these units, particularly where heavy load factors are involved, to act as a valve lubricant and prevent excessive wear. The USDA report also notes that a large number of automobiles and trucks manufactured prior to 1971

---

1 USDA, ERS. Outlook and Situation - Inputs. IOS-4, April, 1984. pp 21-22.

remain in use on farms and in rural areas. These vehicles run high risks of excessive engine wear if leaded gasoline is unavailable.

1978 totals compare with 2.5 million gasoline-powered tractors and 400,000 gasoline-powered combines in 1979--more than half of the total fleet at that time[2].

A look at 1979 data on a regional basis reveals that almost 60% of the gasoline-powered tractors were concentrated in the North Central States:

	Tractor Inventory, 1979 (1,000)
Northeast	225
North Central	1,420
South	605
West	225

Tractors and other on-farm power units are replaced at a much slower rate than automobiles. The 1978 Census of Agriculture indicated that 52% of automobiles owned by farmers were manufactured between 1974 and 1978, while only 19% of the tractors were replaced during that time. Farm implements are built to last longer, and their usage is seasonal. Retirement rates have declined recently, as farmers have turned to more extensive maintenance as a result of hard economic times and energy conserving efforts.

Thus, although the gasoline-powered work fleet on farms is declining, it will remain a significant component for some time.

NCFC member cooperatives have been analyzing their own market profiles, and the consequences of various lead phasedown alternatives. Several examples of their findings may be helpful to the Committee's deliberations.

An independent survey recently completed by an NCFC member company found that on the typical Western Minnesota farm 18 of 23 engines required leaded gasoline for their operation. This equipment included swathers, bail elevators, off-highway grain trucks, combines, chore tractors, farm pick-ups, hydromacs, chain saws, and Briggs and Stratton engines for all manner of augers and the like. Such equipment is critical to farm operations and ordinarily enjoys a low rate of replacement.

---

2 U.S. Department of Commerce, 1979 Farm Energy Survey, AC 78-SR-9.

A study of liquid fuel usage patterns in Indiana found that one-third of farm fuel use is leaded gasoline[3]. The farm market represents about 7 % of the total Indiana market for leaded fuel. Most gasoline powered tractors and combines were found to be located on smaller family farms.

The farmer cooperative petroleum system is facing a market profile which is heavily dominated by demands for leaded gasoline and diesel fuel. In 1982, leaded gasoline comprised 75% of the total gasoline sales by farmer cooperatives . Leaded gasoline accounts for 85% of total gasoline consumption on all farms in 1982.

Yet, in meeting mandatory national EPA lead standards, cooperative refineries have been forced to reconfigure, at considerable expense, and produce large amounts of unleaded gasoline. Over half of the unleaded gasoline produced in the cooperative system is exchanged for leaded gasoline and diesel fuel, in order to meet farmer-owners' needs.

THE AGRICULTURAL ECONOMY IS DEPRESSED

Myriad evidence of the serious condition of the agricultural economy is readily available. The lead into an item appearing on the front page of the Wall Street Journal of June 14th reads, "**FARMLAND PRICES sink further and might not recover for years**".

It notes that new farm bankruptcies and high interest rates are exacerbating a three-year slump in demand for farmland which in some cases is bringing only 75% of last year's price. It goes on to say, "... most farmers themselves are so deeply in hock that they couldn't afford to buy more land...".

Asking farmers to replace equipment that is otherwise useable, but that cannot be fueled, is not the kind of help that farmers need--particularly when they are not the source of the problem. In some cases, this cost burden could be the final straw.

---

[3] Conducted by Farm Research Institute, Urbana, Illinois.

AN OFF-HIGHWAY EXEMPTION WOULD NOT SOLVE THE FARMER'S PROBLEM

So why not exempt sales of leaded product for off-highway (or on-farm) use?

Legislation offered by Senator Durenberger (S.2609) provides this exemption by banning the commercial sale of leaded gasoline for on-highway use by January 1, 1988. The National Council certainly appreciates the Senator's good intentions in this regard.

Unfortunately, the exemption, by itself, is not likely to make leaded product available for the farmer.

Preliminary indications are that lead producers would be unlikely to supply a legislatively narrowed agricultural market with their product at prices which the farmer could afford to pay. They may not, in fact, continue to do business as lead suppliers with a market only 10-20% of current size.

Pipelines may be unable or unwilling to ship leaded product in segregated batches in the small quantities demanded by such a severely curtailed market.

0.1 GRAMS PER GALLON: UNWARRANTED COST INCREASES FOR RURAL AMERICANS

EPA reportedly intends to issue a proposed rule in July which would require refiners to reduce permissible lead levels in leaded gasoline by January 1, 1986. One of their supporting arguments is that this lead level is sufficient to perform the necessary valve lubricating function.

The National Council must strongly oppose such a proposal for a number of reasons.

First, refiners would have insufficient time to undergo the necessary plant reconfigurations.

Second, for many refiners, the costs would be prohibitive at a time when the industry is going through severe economic stress.

Third, the EPA keeps changing the rules in midstream. Each time that refiners make major investments and incorporate the costs into long-range economic planning, they are buffeted by a new shock induced by regulatory fiat.

Fourth, there is considerable debate over whether this drastically accelerated schedule has a justifiable basis in terms of health considerations.

Fifth, and most importantly, the cost of leaded gasoline to farmers would increase by at least 3 cents per gallon. As "price takers" already facing a vicious cost-price squeeze, this comes directly out of their pockets at the worst possible time.

AN ALTERNATIVE BUT EFFECTIVE SOLUTION

Faced with these facts, there is still, we believe, a viable alternative available which would accomplish the objective of reducing lead use without subjecting the farmer to a disproportionate economic hardship.

Phasedown at the Refinery

I. Schedule a drop in the lead standard from 1.1 grams per gallon of leaded gasoline to 0.5 grams per gallon by January 1, 1988.

This represents a sharp reduction in lead content, and, combined with continued retirement of vehicles requiring leaded gasoline, will move well toward the EPA's ultimate goal of "getting the lead out" of the environment.

Refiners need that amount of time to complete reconfiguration (planning, permitting--including environmental, and actual construction). It also gives them a better opportunity to adjust to the large costs.

The EPA could put this time to good use by proceeding with its announced intentions to review rational air quality standards for lead. Better information can be developed upon which to base any decisions on the possible need for further cuts.

The Misfueling Problem

The National Council recognizes that current concern over misfueling is the genesis for much of this renewed debate. More vigorous enforcement of existing regulations and prosecution of violators should be pursued.

A key obstacle to reducing the amount of lead in gasoline, leaded gasoline usage, and the associated health risks, is that leaded product is less expensive to make and sell than its unleaded counterpart.

This cost differential is approximately three cents per gallon at the refinery. Recent data show that many gasoline retailers are evidently using leaded gasoline as a "loss leader"--posting an artificially low price for leaded gasoline to attract motorists. The average difference between unleaded and leaded gasoline at the retail level is currently about six cents per gallon.

Thus, a strong economic incentive exists for owners of automobiles designed to use unleaded gasoline to "misfuel", or use leaded gasoline. According to EPA data, misfueling is a serious problem which needs to be addressed through more vigorous enforcement or other means. If misfueling were eliminated, the industry would now be ahead of the EPA's projected schedule of declining sales of leaded gasoline.

A Possible Solution to Misfueling

This Committee is now looking at the lead issue. We understand that the Chairman also intends to mark up Superfund reauthorization legislation in the near future. The House bill contains provisions which would raise $1.5 billion annually from the petroleum industry by increasing the tax on crude oil (4.5 cents per barrel) and by implementing a new tax on BTX in gasoline ($2.88 per ton).

If, in the final judgment of Congress, new taxes are necessary for this purpose, the National Council would like to offer a proposal which could address both the misfueling issue and superfund revenue needs simultaneously, and in an equitable manner:

II. Apply an excise tax on leaded gasoline at the retail pump equivalent to the current retail price differential between leaded and unleaded gasoline, or approximately 6 cents per gallon.

This would discourage retailers from using leaded gasoline as a "loss leader", and would eliminate the economic incentive to misfuel. It would also constitute a disincentive to the retention of older motor vehicles requiring leaded gasoline.

Such a tax would generate about $2.2 billion, based on 1983 leaded gasoline sales data, and assuming that off-highway usage represents 20% of leaded gasoline sales.

Although the revenues would decline along with leaded gasoline sales over time, superfund needs would decline also.

Application of the existing federal excise tax exemption to gasoline used for off-highway and agricultural purposes, would prevent undue economic harm to farmers.

CONCLUDING REMARKS

In conclusion, the agricultural community is not the source of the lead problem. Yet, farmers can be subjected to severe adverse impacts by any solution carelessly constructed.

The National Council is concerned that negative aspects of existing proposals are unduly harsh on agriculture and rural America, however unintentional those results may be.

Farmer cooperatives have complied with national standards to date even though agricultural markets have never had the concentrations of lead which have been the focus of actions by the Congress and the EPA.

Mr. Chairman, the National Council has offered alternative proposals in a constructive spirit. We are not opposing the ultimate objectives of the program, but rather asking that they be accomplished in a manner which minimizes unnecessary costs, inefficiencies and inequities.

Thank you for the opportunity to speak here today. I will be happy to respond to any questions you may have.

TESTIMONY OF

MARTIN P. ZANOTTI

EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER OF

SABER ENERGY, INC.

BEFORE THE

U.S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

JUNE 22, 1984

- -

Mr. Chairman and Members of the Committee:

I am Martin P. Zanotti and I am Executive Vice President and Chief Operating Officer of Saber Energy, Inc. which is headquartered in Houston, Texas. Saber operates a specialized refinery in Corpus Christi, Texas and engages in marketing, marine bunkering and terminaling operations. The refinery is designed to produce all of its gasoline as unleaded product and is a joint venture with Valero Energy Corporation who owns a 50% interest in Saber Energy, Inc. Valero also operates natural gas pipeline systems primarily serving Texas markets, processes natural gas, markets hydrocarbons extracted from natural gas, engages in oil and gas exploration and production and commercial oil field supply operations.

37-670 O - 84 - 13

First, we strongly concur with the findings as outlined in Section 2(a) of Senate Bill S. 2609 dated April 30, 1986. However, we want to encourage you to make the effective date January 1, 1986 rather than waiting until January 1, 1988 to eliminate this health hazard. Also, if for good and valid reasons, you cannot accelerate the effective date, we would like for the Committee to immediately consider the imposition of a tax on leaded gasoline sales and restrict the importation of leaded gasoline for reasons I will now review.

Refiners have now had over ten years to prepare for lead phasedown. The original lead phasedown regulation was enacted December 6, 1973 and called for all refiners to produce gasoline the lead content of which could not exceed 0.5 gram of lead per gallon of gasoline produced averaged over the calendar quarter effective January 1, 1979. As that date approached, it became apparent the refiners, primarily due to expectations they would be granted exemptions, were not ready. Therefore, the EPA granted a series of postponements to refiners to allow them to get ready. Saber and Valero took advantage of that extension to build a modern, state-of-the-art refinery capable of producing 100% of its gasoline as unleaded. Ourselves and many other

independent refiners proved it could be done by making substantial capital investments.

Current regulations (effective since July 1, 1983) allow almost 50 billion grams of lead to enter our air each year by allowing all refiners and importers to use up to 1.1 grams of lead per gallon of leaded gasoline and by permitting them to transfer or sell surplus "lead rights" to other refiners or importers. During the November 1982 through June 1983 period preceding this effective date, small refiners, many of whom had not spent and were not planning to spend money to upgrade their refineries to produce unleaded gasoline, were allowed to use 1.9 grams of lead per gallon. At the time this waiver was granted, we were committed to spending over $500 million to upgrade the Saber refinery to produce 100% of its gasoline as unleaded. Our projected startup date was June 1983, but we were excluded from the revised definition of small refiner and denied an exception. Therefore, to be fair and equitable to refiners that made substantial capital investments in good faith reliance on the lead levels that EPA regulations projected would be allowed, we want no exceptions or loopholes in the proposed law. This is as it should be because the findings outlined in Senator Durenberger's bill indicate lead is a

more serious health threat than it was thought to be back in 1973.

However, this current regulation is not strong enough. EPA surveys show that 12% of all cars that should be using unleaded fuel are being misfueled because consumers want to save money or obtain cheaper, high octane gasoline. The regulation limits what the refiner can do but does not effectively restrict the consumer from misfueling his vehicle. Aside from the health threat, the unauthorized use of lead gasoline significantly affects the demand for unleaded gasoline and thus in effect operates to penalize the refiners who have made the capital investment to efficiently produce the unleaded gasoline. We see several basic ways to reduce this misfueling:

1. EPA can via current authorized rulemaking procedures further restrict the use of lead in gasoline at the refinery or import level. The current discussion centers on a 0.1 gram of lead per gallon of leaded gasoline limitation which, due to octane costs, should cause leaded gasoline to cost more to produce than the lower octane unleaded gasoline and thus effectively eliminate the economic incentive to misfuel. You should encourage EPA to act in a timely manner on a new

rule to achieve 0.1 gram of lead per gallon by January 1, 1986.

2. Congress can make it unlawful to sell, offer to sale, or introduce into commerce, leaded gasoline. We, like you, prefer this route because there are fewer possibilities for exceptions. Also, because refiners have had adequate time to build unleaded gasoline facilities, we recommend a January 1, 1986 effective date.

3. Congress can tax leaded gasoline sales to destroy the incentive to misfuel. This option will produce revenue for the Federal government.

4. Inspection of all vehicles and suspension of operating license of those that have been misfueled or tampered with until they are restored. This would be extremely expensive to implement.

If you find that domestic refiners are not ready, even though they have had adequate time, and that you must wait until 1988 to limit leaded gasoline sales, Congress should be aware that the current financial markets will probably prevent those refiners that are not ready from obtaining

financing to build the required facilities. Also, while awaiting these unlikely U.S. refinery modifications, Congress should stop or tax leaded gasoline imports so that only domestic refiners benefit from the delay.

I would like to further discuss the cessation of leaded gasoline imports. Saber and Valero spent over a half a billion dollars to build a refinery that can produce 100% of its product as unleaded gasoline. Of this expenditure, $41 million was spent directly on air and water emissions control equipment that many foreign refiners do not have to have. Also, we began start up of our refinery in June 1983 but did not become fully operational until February 1984 primarily due to problems with emissions control equipment. This resulted in lost earnings far in excess of the cost of the pollution control equipment. In March of 1984, 343 thousand barrels per day of gasoline (of which 197 thousand was leaded) were imported into this country from those refineries that probably do not have as restrictive limits on their air and water emissions. This is not fair and is causing the exportation of our refinery industry.

As you know, there has been a lot of publicity recently about EPA's plans to significantly reduce the use of lead in gasoline or to ban it altogether. In fact, it was reported in late April that EPA Administrator William D. Ruckelshaus

had approved development of a notice of proposed rulemaking (NPRM) that would provide for the reduction of the lead content of gasoline to 0.1 gram per leaded gallon by 1986. Although an NPRM has not been issued yet, reports have been heard in the industry from EPA's Fuels Branch that EPA is working on it now and that it may come out some time in mid-July, probably in the form of a proposed rule. The EPA is the most effective and expedient route to control lead usage in gasoline. Based on EPA's misfueling surveys, it is our opinion that lead usage can only be controlled at the point of production or importation of gasoline. I respectfully encourage the Committee to ask EPA to take action immediately.

In summation, we concur with the findings outlined in S. 2609 that lead is a health hazard. We recommend Congress change the effective date to January 1, 1986. If you cannot accelerate the removal date, then we advocate Congress block or tax the importation of leaded gasoline and that Congress immediately tax the sale of leaded gasoline to remove the economic incentive to misfuel.

I thank the Committee for allowing me to speak today and will gladly try to answer any questions the members might have.

Testimony presented by

BEACON OIL COMPANY

before the

SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

June 22, 1984

My name is Michael Redemer and I am with Beacon Oil Company, a small independent refiner and marketer located near Fresno, California. I appreciate the opportunity to appear today before this Committee.

First, I would like to clarify that, while our company is represented on the Executive Committee of the American Independent Refiners Association ("AIRA"), our comments today do not represent the views of that organization. However, my testimony today does represent the consensus of twelve independent refiners, including both AIRA members and non-members, located in California, Indiana, Kansas, Tennessee, and Washington. (See the attached list.)

These independent refiners are concerned about the impact of proposals, such as S. 2609 and the regulatory changes currently being considered by the Environmental Protection Agency, to restrict the use of lead in leaded gasoline.

While we do not wish to debate the issue of the health effects of lead in the environment, we would like to express our concern and raise the following points:

1) The proposed EPA timetable for the reduction of lead in gasoline, reported in the press as 0.1 grams/gallon of lead by January 1, 1986, is too short for many refiners to obtain financing, acquire permits and construct new facilities. As an example, in California any construction project which may have significant environmental impact, such as a refinery expansion, is required to prepare an Environmental Impact Report. The preparation and review process for an EIR can take from six months to one year or longer. Permits are also required from the regional air pollution authority and sources are subject to New Source Review regulations which may require that air pollution emissions be offset. This review and permit process can be extremely lengthy, depending upon the type and size of the source to be permitted and the availability of emission offsets. Generally, at least three or four years are necessary for a refiner to install new octane boosting equipment.

2) In recent years, in the midst of unsettled market conditions, a number of independent refiners already have undertaken expensive upgrades and expansion of their gasoline production capacity. For example, Beacon Oil, after investing a substantial sum of money, in 1980 completed an additional reforming unit to increase our octane production capabilities, a hydrodesulfurization unit and a sulfur recovery unit. The decision to make these additions was driven by the fact that the California Air Resources Board (CARB) had required limitation on the amount of lead in leaded gasoline in 1976. This restriction, coupled with the requirement

for unleaded fuel in catalytically-equipped cars since 1975, forced us to increase our octane boosting capability.

Recently, independent refiners have been struggling in the midst of a volatile product market. In the past six months in California alone, five independent refiners have shut down refineries with two of these companies filing for bankruptcy. At least one of these refiners had made major capital investments in the past three years to enhance its capacity for upgrading bottom-of-the-barrel material. Under current market conditions, it is extremely difficult for independent refiners to obtain the necessary financing for the construction of future new facilities or to expensively retrofit existing units. Thus, time flexibility is extremely important.

3) Historically, the California Air Resources Board has been the most stringent regulator limiting lead in leaded gasoline, and it recently has stated a policy for the complete elimination of lead in leaded gasoline through phased reductions and declining leaded gasoline demand in the marketplace. After holding extensive public hearings in 1982, CARB revised the standards to require California refiners, blenders, and importers to meet a 0.8 gram per gallon standard by October 1, 1984, for leaded gasoline. Additionally, we are required to report every gallon of gasoline which exceeds this level. At the same time, CARB has supported the implementation of automobile inspection and maintenance programs to discourage misfueling and improve the effectiveness of emission controls on automobiles. Surveys by the CARB indicate that misfueling occurs at a rate of 2 to 5 percent in California,

compared to 12 percent nationwide, as reported by EPA in the "Costs and Benefits of Reducing Lead in Gasoline," released in March, 1984.

We would encourage the Committee to pursue the misfueling issue, and to seek passage of legislation which will encourage programs similar to those in place in California. This approach not only will reduce misfueling, but also will maximize the benefits obtained from automobile emission control devices. We applaud Senator Durenberger's efforts in this area, including his amendments to the pending Clean Air Act package.

4) While independent refiners recognize the fact that the leaded gasoline market will continue to shrink, it is important to the survival of many of us that this market process, along with any reductions in allowable lead levels, be allowed to occur incrementally over a number of years. It is also important to recognize that there will continue to be a residual demand for some leaded gas for early model automobiles, trucks, marine engines and farm vehicles.

5) EPA is currently reviewing the ambient air quality standard for lead. The expectation is that this standard will be made substantially lower, based upon studies of population exposure and health effects. This systematic review and revision of the standard, coupled with the ambient air quality data analysis, should be the driving force behind any change in the leaded gasoline lead regulations.

6) The use of other materials, such as alcohols, to boost gasoline octane is limited by a number of factors. Many refiners which do not market their own product to date have not been successful in getting their marketing outlets to accept alcohol blended fuels. Those refiners which do market their own product, such as Beacon Oil, have used ethanol to boost octane, but this has been successful only because of the existence of the federal and California state tax subsidy. Loss of either of these subsidies would render this approach uneconomical.

We propose that any federal legislation address these realities. We would suggest an orderly phasedown of the gasoline lead content to 0.5 grams/gallon by January 1, 1988.

In the interim, we encourage EPA to promulgate a revised air quality standard and to reevaluate the national air quality data to determine if additional lead reductions are necessary in leaded gasoline.

Senator Durenberger's bill, S. 2609, while focused on health issues, has significant national energy policy implications. The imposition of new requirements upon independent domestic refineries in a rapid manner will cause additional refinery closures and drive the capacity for the refining and distribution of petroleum products into the hands of larger domestic and foreign refiners and international oil companies. The long-term implications of this trend will be increased consumer prices at the pump and a further shift of the control of the energy distribution system into fewer hands.

I hope the Committee will consider our concerns in its deliberations. I thank you for this opportunity to address the Committee, and will be happy to answer any questions.

	NAME	LOCATION	CRUDE CAPACITY B/Sd*
1.	Beacon Oil Company	Hanford, CA	18,230
2.	Edgington Oil Company	Long Beach, CA	38,000
3.	Fletcher Oil & Refining Company	Carson, CA	30,500
4.	Golden West Refining Company	Santa Fe, CA	42,300
5.	Kern County Refinery, Inc.	Bakersfield, CA	23,000
6.	Newhall Refining Company	Newhall, CA	21,400
7.	Sunland Refining Corp.	Bakersfield, CA	15,000
8.	Indiana Farm Bureau Cooperative Association	Mt. Vernon, IN	21,500
9.	Rock Island Refining Corp.	Indianapolis, IN	44,500
10.	Pester Refining Company	El Dorado, KS	32,000
11.	Mapco Petroleum, Inc.	Memphis, TN	60,000
12.	U.S. Oil and Refining	Tacoma, WA	27,200

* Barrels per stream day.

REDUCTION OR ELIMINATION OF LEAD IN GASOLINE

TESTIMONY
by
ROBERT T. McCOWAN
ASHLAND OIL, INC.
before
SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE
June 22, 1984

My name is Robert T. McCowan. I am Vice Chairman of the Board of Ashland Oil, Inc. My purpose today is to tell you why Ashland favors the early elimination of lead from motor gasoline.

Ashland Oil is a diversified corporation involved primarily in petroleum refining and marketing. We are one of the nation's largest independent petroleum refiners and a leading supplier of petroleum products to independent marketers. At present we operate refineries at Catlettsburg, Ky.; Canton, Ohio; and St. Paul Park, Minn., with a combined crude oil input capacity of 332,000 barrels per day.

Ashland supports a renewed effort to eliminate the use of lead in motor gasoline. It becomes more apparent each year that such definitive action is necessary if we are to insure continued protection of the public health.

Ashland extends its compliments to this committee for its obvious concern over the vital lead issue, as exemplified by this hearing today. We also want to commend Sen. Durenberger for his personal interest and commitment. We are also aware that the Environmental Protection Agency shares your concern, and plans an early proposal to reduce substantially the maximum lead content of leaded gasoline. We understand that their proposal, when issued, may call for reducing lead content from today's maximum of 1.1 g/gal to a level of 0.1 g/gal, effective January 1, 1986.

Either the adoption of the Senate bill or new EPA regulations would serve to safeguard the public health from current air pollution caused by airborne lead particles resulting from automotive exhausts.

Ashland and others in the industry were skeptical when lead particulate emissions from automobile exhaust pipes were first suggested as a severe health hazard. We then argued that the evidence from the health studies available at that time was not conclusive enough to justify curtailing or banning the use of lead. Nevertheless, in late 1973, EPA required the marketing of unleaded gasoline by mid-1974, and imposed controls on the lead content of leaded gasoline. Later, in 1982, EPA further curtailed the maximum lead content of leaded gasoline to a 1.1 g/gal. standard. EPA hoped that this strategy of phasing down total lead usage, coupled with the introduction of new cars would result in decreased demand for leaded gasolines and constitute an "orderly phaseout."

As we all know, the steps taken so far have fallen far short of achieving our national objectives, for several reasons that are readily apparent. First, an economic downturn slowed auto sales, and thus the projected increase in the number of cars requiring unleaded gasoline. Secondly, and probably more important, many consumers deliberately misfueled their new cars, using the cheaper leaded gasoline. Thirdly, there is no practical or workable way to enforce the program at the gas station.

As a result of these factors, the total leaded gasoline sales remain higher than forecast, at about 43% of total gasoline sales during the first quarter of 1984. The demand for leaded gasoline in Ashland's markets is much higher, averaging about 50% for the first calendar quarter. At the same time, further medical studies confirm, even more conclusively, that airborne lead particles from automobile exhausts are the principal contribution to lead in our environment. New evidence also suggests an even stronger association between leaded gasoline use and severe public health problems than was first believed.

Based on this evidence, we feel that EPA, in making its decisions in 1973 and 1982, properly responded to the harmful effects of lead in gasoline, and put the industry on notice that we would have to "Get The Lead Out" so to speak. We could no longer challenge, nor ignore, that mandate, so we have made major capital expenditures in our refineries to comply.

Ashland has considerable unused octane producing capability. We know that others are in a similar situation, and additional capability is still being completed. Some equipment is not being utilized today because most refinery engineers have been trained to produce gasoline the most efficient and least costly way possible, by adding every gram of lead legally available under existing regulation. And, in today's highly competitive market conditions, survival dictates that one produce gasoline as cheaply as possible. Thus, the situation will not change dramatically until lower levels of lead content are legally mandated.

As a counter to the competition argument for waiting just a few more years, Ashland would point out that a continuation of the existing situation is a severe competitive imposition upon the companies who have already made the responsible capital investments required. Following EPA's initial decree on lead phasedown, Ashland made substantial capital investments for capacity (some of which still stands idle) to upgrade gasoline quality, and in equipment to process lower quality, heavier crude oils into gasoline and distillates. We have spent over $250 million (1984 dollars) toward meeting the expected demand for lead-free gasoline.

In 1981 Ashland invested $16 million in capital expenditures for an isomerization unit at St. Paul Park, MN. That unit has never operated. Similarly, $21 million was spent for a new reformer at our Canton, Ohio refinery, which is operating far below its design capability. The fixed costs on these

investments are a burden to our competitive position, while the units themselves are now doing little or nothing toward solving the national health priority of removing lead from our environment. Certainly it could not have been the intent of the earlier regulations to penalize those who made the necessary investments -- and made them early -- to meet this serious public health problem.

Additionally, we have constructed and are now operating a 4,000 B/D ethanol plant at South Point, Ohio, that produces high octane blend stocks from corn. This plant, too, has yet to reach its full potential and has never made a profit. Other ethanol capacity in the country could be brought on line or expanded when conditions warrant. Ethanol is an environmentally acceptable, lead-free substitute for boosting gasoline octane requirements which could contribute, in part, to the solution.

In short, Ashland is convinced that there is today a great deal of unleaded gasoline manufacturing capacity sitting idle because there is not a ready market for its output. This refining capability, coupled with the decline over the last three years in total gasoline consumption, leaves the industry as a whole with adequate capacity today for producing entirely lead free automotive fuel - and within a relatively short time span. We know Ashland can do it.

In our opinion, EPA already has the authority, under the Clean Air Act, to mandate either the reduction or elimination of lead from gasoline used on highways. From a health standpoint alone, a severe reduction of lead is called for - and as rapidly as possible - in order to insure an adequate margin of safety. However, for the time being, there is a legitimate need for lead as a valve lubricant in some older vehicles and special engines. A very low lead level, such as the 0.1 g/gal that EPA is expected

to propose for leaded gasoline, would serve this need, and still leave a limited but sufficient leaded product generally available.

Ashland favors a regulatory remedy, to be accomplished by the EPA under their existing legal authorities. Certainly, this would be the most expeditious method for achieving our national public health goals. Respectfully, Ashland would like to suggest a three-phase approach, as follows:

1. First, phasedown lead content to 0.5 g/gal in leaded gasoline, to be effective no later than January 1, 1985;
2. Second, further reduce lead content in leaded gasoline to 0.1 g/gal no later than January 1, 1986; and,
3. Finally, ban lead content in gasoline entirely by no later than January, 1988, but continue an exemption for equipment requiring leaded fuel.

Any new standards adopted must be equally applicable to all refiners and blenders. Special exceptions, if granted, would only serve to defeat the objective. New standards, if adopted, should also apply to all imported products. Imports of gasoline blending components should be covered by the identical standards applicable to finished gasoline produced domestically, and the current preferential tariff treatment should be eliminated at the earliest possible moment.

"Get the lead out" is an idea whose time has come! In fact, it is past due. Toward that end, Ashland will be pleased to work with this committee or the EPA in any way we can.

AtlanticRichfieldCompany 1333 New Hampshire Avenue, N.W.
Suite 1000
Washington, D.C. 20036
Telephone 202 457 8255

William T. Christian
Director
Federal Government Relations

August 10, 1984

The Honorable Robert T. Stafford
United States Senate
Senate Hart 133
Washington, DC 20510

Dear Senator Stafford:

Atlantic Richfield Company requests that the enclosed materials be included in the record of testimony offered at the June 22, 1984 hearing before the Senate Environment and Public Works Committee on S. 2609, dealing with the reduction of lead in gasoline.

Our comments are directed at the elimination of restrictions on the use of alternatives to lead as sources of octane in gasoline, principally methanol/cosolvent blends. We would welcome the opportunity to work with the Committee in devising legislative provisions which would ensure that if lead use is restricted in gasoline, cost effective and environmentally sound octane replacements are available on the market. Thank you for your consideration of our views.

Very truly yours,

Bill Christian

William T. Christian

WTC/bjp

Enclosure

COMMENTS ON LEAD PHASEDOWN TO THE SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE

Atlantic Richfield believes that if Congress deems it necessary to legislate a ban on the use of lead in gasoline, such legislation should also contain provisions which insure the availability of alternative octane sources, especially methanol in the form of cosolvent blends to refiners. Increasing the supply of traditional sources of octane to replace lead results in either a reduced supply of gasoline or the need to refine more crude oil; either way increased costs to the consumer result.

In order to minimize the cost of lead elimination, the government should insure that all viable octane alternatives are available to refiners. One key alternative, methanol/cosolvent blends, has been demonstrated to be commercially viable when properly formulated and handled. However, extensive methanol blend usage is inhibited by several structural and regulatory factors which should be eliminated as part of legislation on lead phasedown.

o VAPOR PRESSURE

Recent air quality studies suggest that methanol blends can be regulated differently from traditional hydrocarbon gasolines without deterioration of air quality. This approach would parallel that accorded gasoline use of ethanols which carries no vapor pressure limits.

o PIPELINES

Most of common carrier pipeline companies have restricted or banned the transport of gasolines containing methanol and ethanol blended gasolines. Concerns voiced by pipelines such as system cleanliness, handling, fungibility (interchangeability of fuels), and downstream terminal blending of methanol can be overcome. We believe that a study by the Secretary of Transportation on the transport of methanol through interstate liquid pipeline system, as proposed in H.R.5313 the "Pipeline Safety Authorization Act," should be adopted and completed promptly in order to help overcome this barrier.

Atlantic Richfield Company would welcome the opportunity to participate in development of a legislative framework that will make methanol blends more readily available to refiners and gasoline marketers as a viable alternative octane source.

EXXON COMPANY, U.S.A.
POST OFFICE BOX 2180 - HOUSTON, TEXAS 77001

REFINING DEPARTMENT

EDWARD T. DiCORCIA
VICE PRESIDENT

July 6, 1984

The Honorable Robert T. Stafford
Chairman, Committee on Environment
and Public Works
United States Senate
Washington, D.C. 20510

Dear Senator Stafford:

This letter submits Exxon Company, U.S.A.'s comments for the record of the hearings held on June 22, 1984 by the Senate Environment and Public Works Committee on S. 2609, the Airborne Lead Reduction Act of 1984.

We recognize that both the Congress and the Executive Branch are seeking to reduce motor gasoline lead emissions and to discourage consumer misuse of leaded fuel in cars equipped with catalytic converters. But the government should also consider the gasoline supply impacts of an accelerated schedule to reduce lead in gasoline. As allowable lead antiknock concentrations are reduced, petroleum refiners must turn to other methods of providing the octane required by U.S. motorists. Such methods would likely include utilization of currently spare or shutdown refinery processing facilities and increased use of EPA-approved octane-enhancing additives. However, if the current 1.1 grams per gallon maximum allowable lead concentration of the leaded grade of motor gasoline is reduced below the range of 0.8-0.5 grams per gallon, we believe many refiners will also find it necessary to build new refinery processing facilities to economically meet octane demand.

These new facilities, of course, require design, engineering, procurement, field construction, and start-up which in total usually take several years to complete. Thus, a reduction to substantially lower lead concentrations prior to 1988 would not allow sufficient time for the installation of necessary refining facilities and could negatively impact gasoline supply availability at current levels of octane quality.

We recommend further Committee consideration of S. 2609 be held in abeyance pending the Environmental Protection Agency's rulemaking activities on lead in gasoline and consumer misfueling.

Very truly yours,

ETDC:ng

A DIVISION OF EXXON CORPORATION

Renewable FUELS

Renewable Fuels Association
499 S. Capitol Street, Suite 420
Washington, D.C. 20003
(202) 484-9320

David E. Hallberg
President/Chief Executive Officer

REMARKS OF DAVID E. HALLBERG

PRESIDENT, RENEWABLE FUELS ASSOCIATION

BEFORE THE

SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

HEARING ON S. 2609 AND OTHER PROPOSALS TO REDUCE THE AMOUNT OF LEAD IN GASOLINE

FRIDAY, 22 JUNE 1984

ROOM SD-406, DIRKSEN SENATE OFFICE BUILDING

Thank you very much, Mr. Chairman for this invitation to submit the RFA's written views concerning your legislation S. 2609, a bill to establish definitive dates for the elimination of lead in gasoline, and other proposals. On behalf of the entire U.S. renewable fuels industry, I would first like to thank you, Senator Durenberger, for your outstanding support of the renewable fuels industry during your tenure in the Senate. Your foresight, and that of many of your colleagues in both the House and the Senate, has created an environment that has stimulated private sector investment of over $1 billion in new fuel ethanol production facilities during the past several years, and we hope to make the case today that the industry's demonstrated benefits during that period are directly relevant to the issue your Committee is considering here.

The RFA does not possess sufficient technical expertise to speak directly to the question at hand as to whether or not the use of lead as a motor fuel octane enhancer should be discounted as a matter of national health policy. Obviously, those in the medical and environmental community who are far more qualified have already ably presented their positions. As the national trade association for the producers and marketers of renewably-derived fuel ethanol, however, the RFA does feel qualified to provide the Committee with some general information concerning fuel ethanol's suitability as a replacement for lead as a motor fuel octane enhancer, and to project some likely production levels for fuel ethanol in the near to mid-term to assist the Committee in determining what alternatives to lead might exist in the marketplace.

In the interests of time, I would like to confine my remarks here to two general questions: to what extent does fuel ethanol serve as a suitable replacement of tetraethyl lead as a motor fuel octane enhancer; and, given the approximate "octane gap" that is expected to result from the elimination (or near-elimination) of lead, to what extent could U.S. fuel ethanol production capacity be expanded, and what share of that gap could it realistically meet? While I would like to confine the main body of my comments to these two very specific issues, I have also attached recent comments submitted to the House Ways and Means Committee's Ovesight Subcommittee of a more general nature that deal with the relative value of a domestic fuel ethanol industry in terms of its agricultural, energy security, job creation, and environmental impacts. If it is appropriate, I would ask that these comments also be included in the written record, since it is clear that all too many policymakers still fail to recognize these important linkages, and that ethanol's synergism and net positive budgetary and economic impacts are still lost on them. In short, it is critical that the Committee take into account the uniqueness of the fuel ethanol industry in terms of its net budgetary impacts if fuel ethanol is to be afforded the opportunity to make what could be a major contribution to closing the "octane gap" that would result from an elimination of lead in gasoline.

As Attachment I attests, it is possible to measure the likely octane gap that would result from a lead ban in terms of "gallons of alcohol equivalent". An anlaysis conducted by a highly respected

environmental consulting firm, Herman and Associates, indicated that a total ban on lead would generate an "octane gap" in U.S. refineries of up to 70 billion gallons of "alcohol equivalent" over the cumulative period 1984 through 1992. In recent testimony before the House Science and Technology Committee's field hearing in Decatur, Illinois on July 3, 1984, the Deputy Director of the Department of Energy's Office of Alcohol Fuels stated that a total phaseout of leaded gasoline by 1993, if "all lead were replaced by ethanol...35 to 70 billion (cumulative) gallons of ethanol equivalent octane enhancers would be needed between 1986 to 1992." It is clear, then that a lead ban would give rise to a significant need for ethanol.

The recognition of the substantial "octane gap" that a lead ban would create leads us to the next question: where does ethanol fit in with regard to the range of alternatives available to refiners, both in terms of ability to do the job, as well as economic competitiveness? This is an especially important public policy question in light of the potential anti-competitive effects a lead ban could have on the petroleum refining industry due to a possible squeeze on independent refiners. For example, if increased fuel ethanol availability could contribute to increased independent refiner competitiveness, there would be yet another benefit to the nation from expanded ethanol production.

The past five years of the fuel ethanol industry's development has made it abundantly clear that ethanol is a readily accepted and technically suitable--if not superior--octane enhancing additive. Categorized as an oxygenate by refinery experts (as is methanol), ethanol has received rigorous scrutiny in recent months by objective experts ranging from the Ethyl Corporation to Ashland Oil Inc. In addition to the fact that 10 percent ethanol blends are warrantied by all of the major automobile manufacturers, and receive full waiver coverage by the EPA, the technical data also shows that ethanol has one of the highest octane ratings (Research octane blend value - 132, Motor 103), and its costs per octane number barrel are extremely competitive as long as the tax incentives are considered (see Attachment II).

Ethanol has superior effects in a second very important technical area that must be considered when measuring the cost/benefits of banning lead: its ability to reduce the so-called "crude oil penalty" that arises when lead is replaced by energy intensive refinery methods such as high severity reforming. Attachment III is an excerpt from a recent Ethyl Corporation analysis of the leading oxygenates, which found that ethanol was substantially more effective than the other contenders in terms of displacing imported crude oil, in that it served not only the 10 percent displacement function, but also provided an additional crude oil savings by reducing the amount of energy intensive reforming required to achieve the same octane levels.

For a more detailed view of how ethanol can be compared against the range of alternatives available to a refiner, I have attached graphs taken from a recent presentation made by Mr. Wayne D. Kuhn of Arco Chemical Co. at an international alcohol symposium in Canada. Attachment IV sets out the basic options now available to refiners--increasing reformer severity, adding incremental butylene

alkylation, or purchasing toluene--and their approximate costs. Attachment V then sets out the conventional process octane options available through refinery upgrades (which are highly capital intensive) and their costs. Attachment VI lists the conventional process octane options that can be achieved through chemical reactions (and which face various feedstock constraints of one type or another in most cases) and their costs. Attachment VII then provides a rating table for the leading additives and oxygenates, with the most meaningful line for the purposes of this analysis the "VALUE ¢/GAL". It can be seen that, of all the additives considered by Arco and Sun (who themselves are not involved in the fuel ethanol business, and must therefore be considered "objective"), ethanol had the highest value to the refiner in terms of octane enhancement effects.

Hopefully, this brief review of the literature has securely established the argument that ethanol is, on balance, one of the best, if not the best, options available to U.S. refiners to replace lead as a motor fuel octane enhancer. The only obstacle to its widespread use, it would seem (other than the elusive one of the refiner leeriness of a new product that they can't directly control) is the question of price. Obviously, this is where the question of the appropriate role of public policy comes up: to what extent is it merited for the federal government--on the basis of the evidence of ethanol's national benefits in terms of agricultural program cost reductions, new economic activity generation, energy security augmentation, and now, potential for significant contributions to easing of the octane gap in an environmentally benign way--to establish a nationally uniform tax incentive level sufficient to stimulate a major expansion of fuel ethanol production?

Attachments VIII, IX, and X depicit the dramatic production growth story of the U.S. fuel ethanol industry: from ground zero to over 500 million gallons in just five short years. In 1984, over 5 billion gallons of ethanol-enriched fuels will be purchased by motorists around the country--the equivalent of well over 80 billion miles of driving!

In recognition of the country's need for a greatly expanded domestic outlet for agricultural commodities, the National Corn Growers Association has officially adopted as one of its top legislative priorities the conversion of 1 billion bushels of grain equivalent into ethanol by 1990--a five-fold increase in current ethanol production capacity. In rough numbers, the attainment of this objective would mean that 10 percent of the nation's corn crop would be meeting up to 50% of the projected cumulative octane gap (in ethanol equivalent). Given the appropriate public policy signals, the U.S. fuel ethanol industry can meet such a goal. In fact, only one signal would likely be necessary to stimulate the desired response: a complete elimination of the Federal excise tax on gasoline for ethanol-enhanced fuels.

The renewable fuels industry credits the leadership of members like Senator David Durenberger who have already perceived the rationality of such a policy change. By eliminating the tax on ethanol-enriched fuels, the way would be open to eliminate the balkanized system of 32 state tax exemptions that are now necessary to complement the federal partial

exemption. This would allow for the optimum marketing of fuel ethanol throughout the entire nation in its highest value use: as a motor fuel octane enhancer to replace lead. The documentation that has been built up over the past five years is very convincing: such a move to expand the domestic fuel ethanol industry would be one of the soundest investments the nation could make toward the achievement of multiple policy goals: a stronger, more profitable agricultural sector; reduced taxpayer spending for idling of productive land and resources; increased energy security; improved refinery efficiency with enhanced environment and health; and more productive investment of dollars not "exported" for foreign oil producers in job creating enterprises throughout the United States.

Thank you, Mr. Chairman, for this opportunity to make known our views on your legislation, and for your leadership in this critically important area.

STATEMENT OF
UNION OIL COMPANY OF CALIFORNIA
CONCERNING PROPOSALS TO REDUCE THE AMOUNT
OF LEAD IN GASOLINE (S.2609)

HEARINGS BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
JUNE 22, 1984

Union Oil Company of California (Union) appreciates the opportunity to submit these comments with respect to the June 22, 1984 hearing on proposals to reduce the amount of lead in gasoline (S.2609). This statement does not represent a comprehensive discussion of the subject, but is intended to provide the Committee with a brief summary of Union's views regarding equal treatment for all refiners and the timing of lead reduction proposals.

At the outset, we wish to make it clear that Union is not opposed to a lead phasedown in gasoline, providing it is done in a responsible and rational manner. We believe, however, that the timing being suggested by some parties is not well conceived and could cause unnecessary disruptions in the industry. Any acceleration in phasedown must recognize that sufficient time needs to be provided all refiners to obtain the necessary environmental permits and then to construct or modify their facilities, as necessary, to cope with new constraints.

In 1982, just two years ago, the Environmental Protection Agency held several days of hearings on lead phasedown and received numerous statements over a period of several months, representing all viewpoints. The resultant rule-making specified a 1.10 gram/gallon lead level applied to leaded gasoline only, and fairly applied that limit to all refiners, importers, blenders and marketers alike.

This rule provided Union, as well as all other refiners, with a basis for planning for octane improvement facilities to cope with a lead phasedown over time. In many cases, these new facilities would not have been required until the very late 1980's. Construction of those faciities would be timed for completion when they were needed, not for completion many years in advance and then left idle in the intervening years.

One of the principal provisions in the 1982 rule was equal treatment for all refiners, importers, blenders and marketers alike. Union strongly supported that provision. This same provision must be clearly and strongly preserved in any future lead phasedown ruling. The surest way to accomplish this is to provide sufficient time for all refiners to expeditiously move up their investment plans, if such investments are required to offset the loss of octane provided today by lead. Accelerating the phasedown to dates as early as 1985 or 1986, as has been suggested, clearly does not provide adequate lead time for design, environmental permits, and construction of such new equipment. As a result, disruptions in gasoline quality and supply would likely occur, and requests for special treatment would undoubtedly be intensified.

Whatever reduced lead level is ultimately adopted, it must be done in such a manner as to permit all refiners the time to react responsibly. Although a modest reduction in lead prior to 1988 may be possible, it should be accomplished only after appropriate EPA public hearings giving all refiners an opportunity to make their individual positions known. Any substantial change, such as a reduction to 0.2 gram/gallon, should not be implemented until the post-1988 period. The changes should then be made final. Continual changes in the rules do not benefit anyone.

Thank you once again for the opportunity to submit these comments.

Respectfully submitted,

W. E. Branstrom
Director of Planning
Union 76 Division
Union Oil Company of California

98TH CONGRESS
2D SESSION

S. 2609

To amend the Clean Air Act with regard to mobile source emissions control.

IN THE SENATE OF THE UNITED STATES

APRIL 30, 1984

Mr. DURENBERGER (for himself and Mr. GORTON) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

---

A BILL

To amend the Clean Air Act with regard to mobile source emissions control.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Airborne Lead Reduction Act of 1984".

SEC. 2. (a) FINDINGS.—The Congress finds that—

(1) ambient air concentrations of lead exceed four thousand to five thousand times its natural conditions;

(2) automobile emissions account for 35 per centum to 45 per centum of the blood lead found in

children, especially those between the ages of one and six;

(3) lead is known to damage the kidney, liver, the reproductive system, blood creation, basic cellular process, and brain functions;

(4) children with high lead blood levels suffer irrepairable brain damage, mental retardation, and even death, while children with low lead blood levels do more poorly on intelligence tests, have a higher incidence of speech impairment, fail more frequently academically, and require more pyschiatric referrals;

(5) the Environmental Protection Agency, under section 211 of the Clean Air Act has made great strides in reducing the amount of lead used in gasoline; and

(6) because a significant correlation exists between the reduction of lead in gasoline and lower lead blood levels, a ban on the sale of leaded gasoline is the most cost effective way to further reduce levels of airborne lead and further reduce the health hazards of lead.

(b) The purpose of this Act is to ban the sale of leaded gasoline except for limited quantities as determined by the Administrator of the Environmental Protection Agency.

SEC. 3. Section 211 of the Clean Air Act is amended by adding at the end thereof the following new subsection;

"(h)(a) Not later than January 1, 1988, it shall be unlawful for any person to sell, offer for sale, or introduce into commerce, leaded gasoline for general use as a fuel for any highway motor vehicle. Under regulations promulgated by the Environmental Protection Agency leaded gasoline may be offered for limited sales.".

○